GREY WATER DISPOSAL FROM PLEASURE BOATS

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1.0 INTRODUCTION

1.1 General

Over 90,000 km^2 of waterways are accessible for recreational boating in Ontario, providing a large diversity of available boating landscapes ranging from high density urban areas, white sand beaches and secluded bays, to rugged, rocky bluffs, shores and islands. These waterways are heavily used during the peak boating season of July and August with up to 40,000 vessels present.

This large boating population is comprised of sailboats, power cruisers and house boats. The house boats generally frequent the quiet waters of the Trent and Rideau Canals and Lake of the Woods. Sailboats and power cruisers are found in these inland waters as well as in the open waters of the Great Lakes. The boats typically travel about the waterways during the daylight hours and seek out secluded anchorages and marinas for overnight accommodation.

Recreational boating has increased markedly in the last few years and is expected to continue to grow in popularity. With this increased boating pressure comes heightened concern from fisherman, cottagers and others, for the effects of this increased usage of the waterways. Specifically, concern has been expressed as to the effects of the direct discharge of grey water from recreational boats to the receiving waters.

Grey-water discharges are comprised of spent potable/fresh water used for "household" purposes, including water from galley sinks, head washbasins, and showers. On power cruisers and sailboats, grey water from the galley and head washbasin are typically discharged by gravity into the waterway through a submerged hull outlet. To dispose of grey waters from the shower sump, which is generally below the waterline, an electric or manual pump with an anti-siphon loop is typically provided, connecting into the drain pipe used for the washbasin. On houseboats, all grey waters typically discharge through drains to a point just above the waterline.

Concerns about the increased boating activity, and hence, increased grey-water discharges, relate not only to the perceived contamination of the waterways, but also to aesthetic effects including foaming, particularly in the softer water shield areas.

Sensitive areas are notably in restricted waterways and embayments such as those found in the Trent-Severn system, where boaters are in close proximity to cottagers and permanent residents. Inland waterways and bays may have minimal water exchange and high densities of boats, leading to more severe conditions than would be found in the open waters of the Great Lakes and larger inland lakes.

A previous study into the issue of grey water discharges from recreational vessels was commissioned by MOE (MacLaren Engineers, 1987). This study drew several conclusions from a literature review and cursory modelling study of the effects of grey water discharges. These included, among others:

1. "Available data on this subject indicate that bacterial pollution levels from grey water discharges can exceed the safe limit for recreational water uses (swimming, etc.) under certain high-season conditions. Chemical pollution levels are less significant."

2. "Recreational waterway sensitivity extends from lowest in the Great Lakes system to highest in a small quiet bay scenario involving maximum boating density in high-season."

The report also concluded that the grey water from recreational boats could be retained on-board but that such a measure would have the following implications:

- o increased boater costs for initial installation, and for subsequent pump-outs;
- o enforcement enhancement; and
- o modification of certain existing pump-out facilities to accommodate greater loadings, and construction of new pump-outs where required.

The MacLaren study recommended that a comprehensive sampling and analysis program be undertaken to identify the actual characteristics of the grey water from Ontario recreational boats and to determine the effect of the discharge of these waters upon the sheltered embayments which these vessels frequent.

The Ministry of the Environment commissioned the present study of the grey water discharges from recreational vessels with the following objectives:

- determine the quantity of grey water, from each type of fixture, and quantity of blackwater produced aboard 3 types of boats - a sailboat, houseboat and power cruiser;

- collect samples of grey water from each fixture type on each of the 3 boats to determine bacterial characteristics;

- analyse receiving water at peak times of grey water discharge to determine bacterial characteristics;

- evaluate the environmental significance of grey water discharges in areas of greatest recreational boating density;

- survey the pump-out stations in 5 well-known areas to determine the capacity of the facilities to accept enhanced amounts of sewage.

2.0 STUDY DESIGN

This section describes in detail the work plan of the project according to the three main activities of on-board grey water sampling, instream sampling, and the survey of pumpout facilities.

2.1 On-board Sampling

The range of possible types of pleasure craft capable of generating grey water discharges is broad and includes any type of craft with any of the following fixtures: galley sink, head sink, and head shower. For the purposes of the present study three "generic" types of boats were considered each having a shower, a head sink, and a galley sink. These were a power cruiser, a sail boat , and a houseboat.

Quantification of the loading of grey water from each type of boat required an on-board sampling program to measure both the bacterial concentration in grey water and the corresponding volume of grey water produced. It is well established that bacterial concentration measurements can be highly variable, hence measurement programs must contain a sufficient number of samples to allow for statistically significant testing of results. Accordingly the sampling program established for this study was designed to provide an appropriate number of samples and associated quality control tests to allow for a rigorous evaluation of the results.

The on-board sampling program was designed to ensure that the samples collected were representative of the "boaters lifestyle". This required that the boats be operated by crews representative of the most probable types of boat operators and that conditions on board be maintained as closely as possible to typical conditions encountered on-board pleasure boats. The locations chosen for boat operation were limited by the requirement of being able to deliver the grey water samples to the laboratory for analysis not more than 24 hours following collection. Given the above constraints and the further constraint of finding available boats of the required type with the required grey water fixtures limited the geographical scope of the study area to Southern Georgian Bay and the Trent System between Port Severn and Peterborough.

To provide the required range of lifestyle on each type of boat three crews were used per boat for a total of 9 individual crews. The range of crew types included single couples, two couples, groups of 4 singles, couples with babies, and couples with young children. Through several discussions between Beak project staff and MOE personnel the following sampling schedule was developed:

Boat type	Duration of Charter	Crew No.	Type of Crew	No. of "normal" Samples Taken (1)
Houseboat	21 days	1	2 couples	24
		2	1 couple with 1 child	24
		3	2 couples with 2 children	24
Power cruiser	21 days	4	1 couple with 2 children	24
		5	4 singles	24
		6	1 couple	24
Sailboat	18 days	7	2 couples	24
		8	4 singles	24
		9	2 couples	24

1. "Normal" samples were collected from each of the shower, head sink, and galley sink twice daily, once in the morning and again in the evening.

Each of the sailboat crews were on-board for 5 consecutive days, each of the powerboat and houseboat crews were on-board for 6 consecutive days. For each type of boat and for each crew, samples were collected over consecutive 4 day periods. The overall sampling period spanned the interval from 27 July 1987 through to 14 August 1987. On

all boats the internal plumbing was modified to allow collection of the samples from the standard piping at a point prior to discharge.

Each of the samples was collected into a pre-sterilized Nalgene bottle with 5 litre capacity for the head and galley sinks and 10 litre capacity for the shower. With the exception of the volume of water used by some crew members during showering, these bottle sizes allowed virtually the complete contents of the various fixtures to be captured. A sub-sample for bacterial analysis was taken out of each Nalgene bottle into a pre-sterilized 100 ml glass bottle. All samples were stored on ice while on board the boats and during transportation to the laboratory. Samples were picked up from the boats and delivered to the laboratory on each day of sampling.

In addition to the samples taken as described above, two extra 100 ml sub-samples for on-board quality control checks were taken during one of the morning sampling periods of each crew on each boat for each fixture. To evaluate the effect of the galley sink piping special samples of the galley sink contents prior to release and from the boat piping as normally sampled were taken once by each of the first 2 crews on each boat.

This on-board sampling program generated 216 normal samples, 12 special samples, and 54 quality control samples for a total of 282 samples.

Grey water generation and overall fresh water use was monitored on board each boat by recording the volume of fresh water used at the time of each fresh water tank filling. This was accomplished using a calibrated positive displacement totalizing water meter similar to those used to meter domestic water use. Black (toilet waste) water generation was estimated by measuring the capacity of the waste holding tank in each boat and recording the frequency of pumpouts. As a check on this system for black water estimation a system of pumping the black water into a graduated 55 litre carboy was used.

2.2 In-stream Sampling

The objective of the in-stream sampling program was to determine the local effects of greywater discharges from pleasure boats by monitoring bacterial water quality and boat density in sheltered embayments with limited water exchange and minimal external influences.

To achieve this objective three sheltered embayments were selected: two on southern Georgian Bay (Figure 2.1), and one on the central Trent Canal (Figure 2.2). These general locations were chosen because of the large number of recreational boaters frequenting the bays and coastal areas, the large number of sheltered embayments, and the historical concerns over deteriorating water quality particularly in the Trent Canal system. From a logistical perspective these areas were also ideal as samples could be picked up and delivered to the Toronto laboratory for analysis within 24 hours of collection.

Theoretically, the objectives of this component of the study could best be met if the selected embayments were small in volume, completly free of bacterial inputs other than from recreational boating, and had limited exchange flow with the surrounding water. This combination of physical factors together with a high density of boats would maximize the probability of detecting a deterioration in bacterial water quality due to recreational boating. However, practical considerations limited our selection of candidate embayments. Most of the study area has extensive shore line development with its associated bacterial sources, and open channels allowing both safe boat traffic and large volume exchange with surrounding waters.

Following several discussions on likely candidate sites with MOE regional staff, Parks Canada personnel, and MNR regional staff, the following three areas were selected for study:

Lost Bay	Georgian Bay Islands National Park Beausoliel Island
Frying Pan Bay	Georgian Bay Islands National Park Beausoliel Island
Blind Channel	Trent-Severn Waterway Pigeon Lake

Samples were collected from 10 pre-selected locations within each bay and at one control point outside of each bay. Collections were made morning and evening on three consecutive days over two weekends during the summer of 1987 (August 1,2,3; August

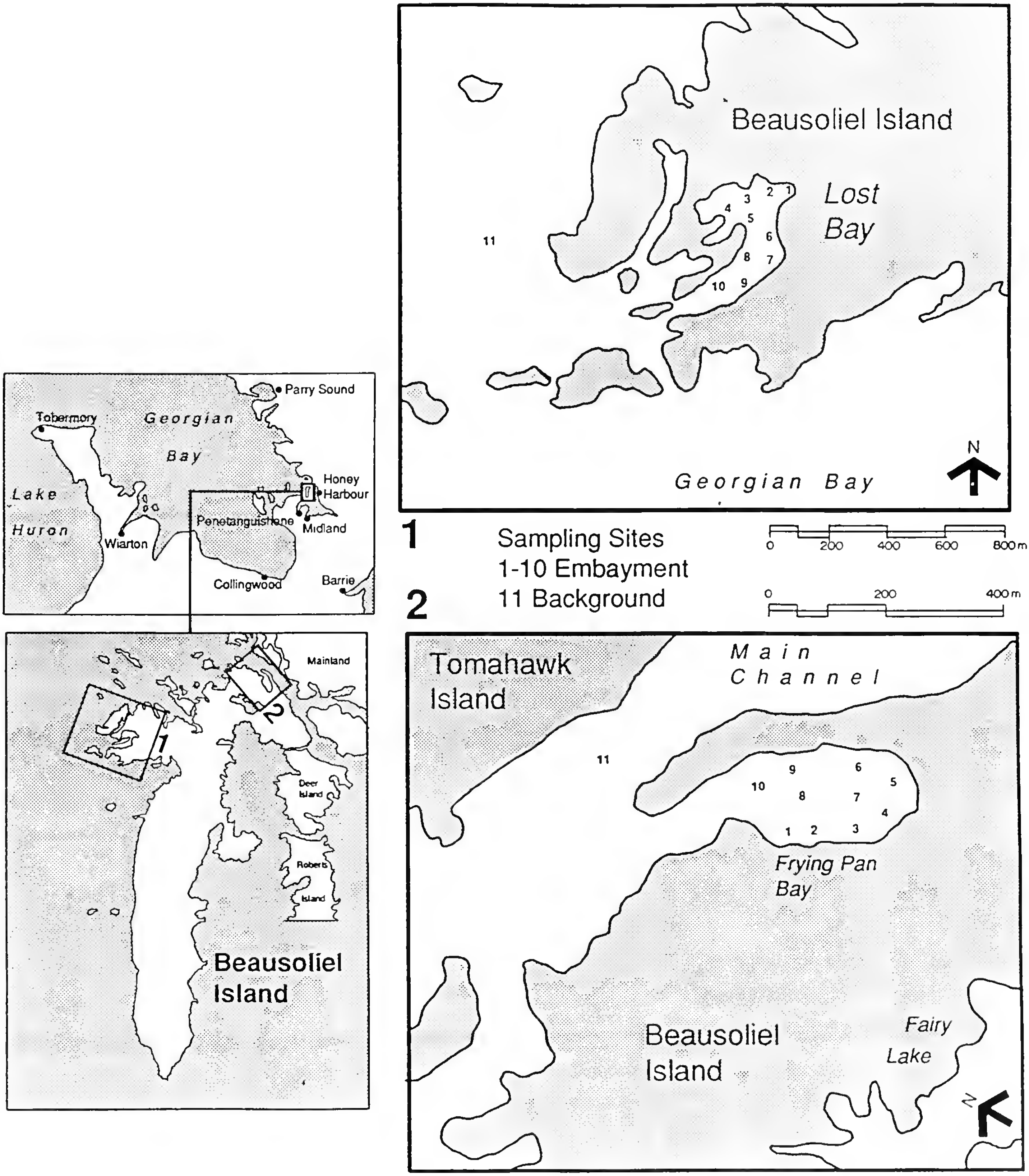
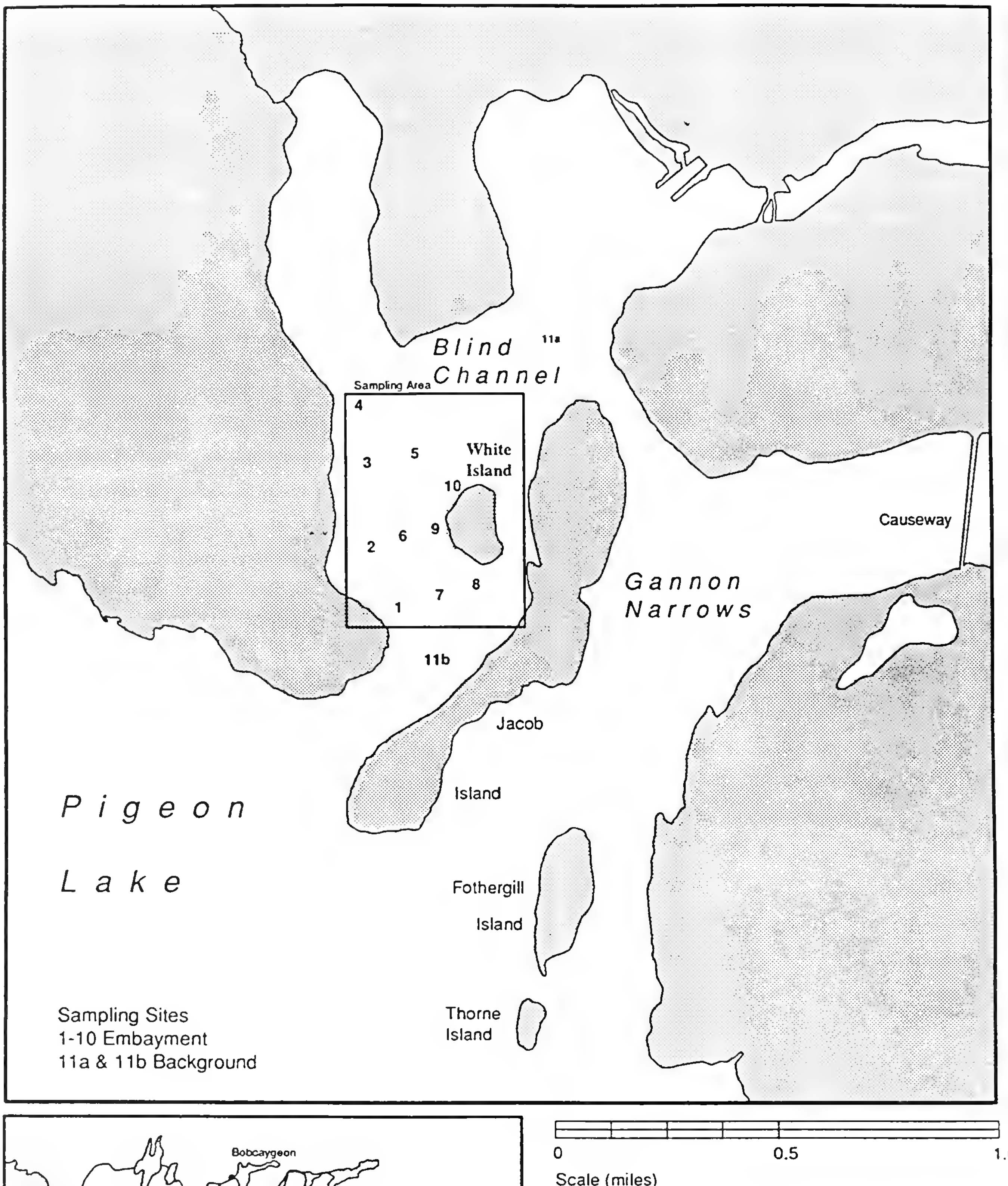


FIGURE 2.1
Southern Georgian Bay
Sampling Locations



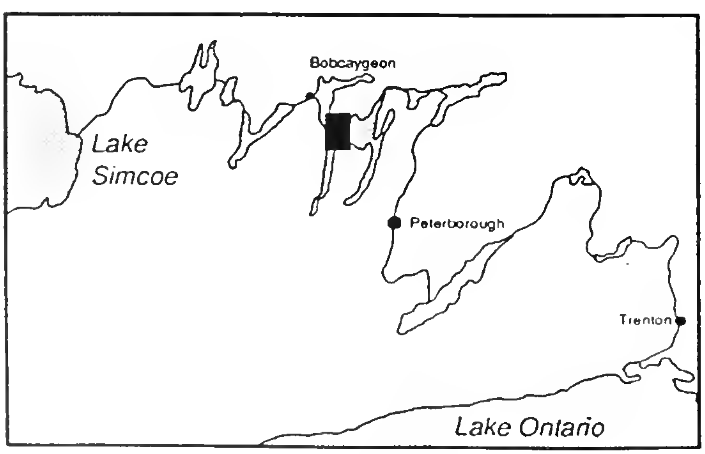


FIGURE 2.2
Instream Sampling Location-
Blind Channel,
Trent Canal System

8,9,10) for a total of 396 regular samples. An additional two quality control samples were collected from each sampling site in each bay in the morning on August 2 and again on August 9 for an additional 132 samples. During each sampling period the number and type of boats in each of the embayments were noted according to the following classifications:

Type	Presumed Grey Water Fixtures
Sailboat A	Head and galley sinks, shower
Sailboat B	Head and galley sinks
Houseboat	Head and galley sinks, shower
Power cruiser A	Head and galley sinks, shower
Power cruiser B	Head and galley sinks
Runabout	Galley sink

During each day of sampling drift drogues with vane depths of 1 metre were placed in the entrance channels of each embayment to qualitatively assess exchange flow. The progress of the drogues into or out of the embayments and the elapsed time of movement were noted. Water temperature and general weather conditions were also noted.

2.3 Bacteriological and Chemical Characterizations

All samples were stored on ice after collection and were transported to Toronto for analysis within 8 to 24 hours. The schedule of analysis and laboratory procedures were specified by MOE in the Study Terms of Reference. The salient points are reproduced below.

Each sample was analysed for fecal coliforms, E. coli, and Pseudomonas aeruginosa. In addition, the first three on-board grey water samples from each fixture on each boat were analysed for the following parameters:

Fecal streptococci,
Total phosphorus (as P),
Soluble phosphorus (as P),
Total solids,

Suspended solids,
BOD_5,
Total organic carbon,
Chemical oxygen demand,
Ammonia (as N), and
Total kjeldahl nitrogen (as N).

Laboratory procedures for the analysis of fecal coliforms, *Pseudomonas aeruginosa* and fecal streptococci were in accordance with the procedures specified in MOE's "Handbook of Analytical Methods for Environmental Samples" ("HAMES"). Laboratory procedures for *E. coli* followed the procedure outlined in the Study Terms of Reference. Verification of *E. coli* by isolation and identification of presumptive target colonies was completed on the first 6 on-board grey water samples per boat per fixture.

In addition to the samples collected for analysis which included in-field quality control samples as described in sections 2.2 and 2.3 above, in-lab quality control replicate bacteriological analyses were performed on a minimum 5 percent of the samples.

2.4 Marina Pumpout Capacity Survey

A survey of excess pumpout capacity was undertaken to assess the reserve capacity available within the existing pumpout network should MOE elect to regulate the disposal of grey water in the same manner as black water. There are approximately 380 pumpout facilities within the province. For the purposes of the present study, five areas were selected for the survey. These were as follows:

	Region	Number of Pumpout Facilities
1	Trent System - Peterborough to Rosedale	32
2	Kingston area and Rideau System - Kingston to Smith Falls	23
3	Georgian Bay - Penetanguishene to Honey Harbour	22
4	Toronto area - Bronte to Oshawa	27
5	Lake of the Woods - Morbon to Keewatin	14
		118

With the exception of the Lake of the Woods area which was surveyed by telephone, each of the other areas was surveyed by site visits. Those facilities in areas 1 through 4 which could not be located, or where personal interviews were not possible were followed up by telephone contact. In all cases a questionnaire identical in form to the sample presented in Figure 2.3 was completed. The data compiled from the questionnaires were analysed for residual capacity and difficulties which might be encountered with increased demand.

SAMPLE QUESTIONNAIRE

SURVEY OF PUMPOUT STATIONS

Site Visit: ____________

Telephone: ____________

Name: ____

Location: ____

____

______________________________ Telephone: ____________

Contact: ____

Pumpout Capacity: ______________________________________
(Volume + # Tanks)

Number of boats serviced at a time: ____________________________

Any access problems: ______________________________________

Disposal method from holding tanks: ____________________________
(haul by truck, septic tank, leach bed)

Anticipated problems in providing more frequent removal/disposal from holding tanks:

____

____

____

____

Other comments/remarks: ____________________________________

____

____

____

FIGURE 2.3

3.0 RESULTS AND DISCUSSION

3.1 Grey Water Sampling

3.1.1 General

The sampling onboard the three boats was carried out by intercepting the flow from the head sink, the galley sink and the shower prior to discharge overboard. Samples were collected twice daily, in the morning and evening and were shipped to the laboratory for analysis within 24 hours. All samples were analysed for fecal coliform, *E. coli* and *Pseudomonas aeruginosa*. A limited number of samples collected early in the sampling program were also analysed for fecal streptococcus. Approximately 22% of the samples were duplicated to provide a quality assurance data set. The results of the analyses are presented in Appendix A and summarized in Tables 3.1 (by boat) and 3.2 (by fixture).

3.1.2 Grey Water Data Analysis

The analysis of the data from the boats was intended to determine differences in the characteristics of the grey water based upon different crews, different fixture types and different boat types. To accomplish this, the data were first reviewed visually in tabular and graphical form where appropriate and then subjected to various Analysis of Variance statistical tests.

The geometric mean of the fecal coliform densities varied from 10^4 to 10^8 organisms per 100 ml over the entire data set. The galley sink water appeared to have the highest density of the three fixtures with values in the 10^7 organisms per 100 ml range. Densities in the head sink were found to be in the 10^5 to 10^7 organisms per 100 ml range and the shower waters ranged from 10^4 to 10^7 organisms per 100 ml. These values exhibit good agreement with the values reported by MacLaren (1986) in their review of the literature. In fact, the values reported by MacLaren for black water are occasionally less than the grey water values found here.

The variation in densities between fixtures and between boats is not distinct. Box plots of the results indicate some overlap in the measured ranges due to the large variances and that any differences between the fixtures, crews or boats may be incidental (Figures 3.1 to 3.2).

TABLE 3.1: SUMMARY OF BACTERIOLOGICAL RESULTS OF ON BOARD SAMPLING, BY BOAT, CREW, AND FIXTURE[1]

Crew	Fixture	FECAL COLIFORMS Geo Mean Concentration (/100 ml)	FECAL COLIFORMS Mean of Log	FECAL COLIFORMS Variance of Log	E. COLI Geo. Mean Concentration (/100ml)	E. COLI Mean of Log	E. COLI Variance of log	PSEUDOMONAS AERUGINOSA Geo. Mean Concentration (/100ml)	PSEUDOMONAS AERUGINOSA Mean of Log	PSEUDOMONAS AERUGINOSA Variance of log
HOUSEBOAT										
1	GALLEY	1.40×10^7	7.146	0.662	1.07×10^7	7.028	0.918	9.42×10^2	2.974	0.590
2	GALLEY	6.54×10^8	8.816	0.148	2.68×10^8	8.428	0.152	1.71×10^4	4.234	2.835
3	GALLEY	1.94×10^8	8.288	0.292	6.14×10^7	7.789	0.406	1.00×10^4	4.000	0.286
1	HEAD	2.99×10^6	6.476	1.787	2.24×10^6	6.349	1.637	1.09×10^3	3.037	0.780
2	HEAD	1.34×10^7	7.128	0.052	3.22×10^6	6.508	0.274	1.43×10^4	4.156	0.153
3	HEAD	9.88×10^6	6.995	0.064	2.57×10^6	6.409	0.237	3.07×10^4	4.488	0.198
1	SHOWER	1.23×10^6	6.088	1.279	4.56×10^5	5.659	1.431	1.86×10^2	2.269	0.437
2	SHOWER	1.49×10^7	7.173	0.272	5.37×10^6	6.730	0.463	4.58×10^3	3.660	0.922
3	SHOWER(2)	4.69×10^5	5.671	0.001	4.53×10^5	5.656	0.002	3.00×10^4	4.476	1.856
POWERBOAT										
4	GALLEY	6.19×10^7	7.792	0.756	5.30×10^7	7.724	0.654	3.51×10^5	5.545	2.198
5	GALLEY	1.16×10^7	7.064	0.185	9.35×10^6	6.971	0.159	2.20×10^5	5.343	2.820
6	GALLEY	1.92×10^7	7.282	2.313	1.49×10^7	7.174	2.168	1.68×10^6	6.226	0.684
4	HEAD	4.89×10^5	5.690	0.471	3.77×10^5	5.577	0.396	4.36×10^4	4.639	0.572
5	HEAD	3.44×10^5	5.537	0.661	2.42×10^5	5.383	0.780	1.37×10^4	4.137	0.656
6	HEAD	1.32×10^5	5.121	0.733	1.24×10^5	5.095	0.739	8.55×10^4	4.932	1.051
4	SHOWER	2.48×10^6	6.394	0.557	2.14×10^6	6.331	0.411	2.43×10^6	6.385	0.345
5	SHOWER	1.69×10^6	6.228	0.584	1.63×10^6	6.213	0.585	6.00×10^4	4.778	0.633
6	SHOWER	1.90×10^6	6.279	1.203	1.64×10^6	6.215	1.132	6.67×10^5	5.824	2.100
SAILBOAT										
7	GALLEY	6.28×10^4	4.798	7.213	4.56×10^4	4.659	7.192	1.51×10^4	4.180	1.053
8	GALLEY	2.16×10^7	7.335	1.369	1.20×10^7	7.079	1.700	9.13×10^3	3.961	1.825
9	GALLEY	6.20×10^7	7.792	0.144	5.96×10^7	7.776	0.153	1.13×10^4	4.052	0.157
7	HEAD	1.44×10^5	5.159	1.012	7.91×10^4	4.898	1.442	1.85×10^3	3.267	0.643
8	HEAD	2.10×10^6	6.323	0.629	1.19×10^6	6.075	0.519	4.50×10^5	5.653	0.520
9	HEAD	7.86×10^6	6.896	0.155	3.38×10^6	6.529	0.463	2.59×10^6	6.413	0.304
7	SHOWER	9.74×10^4	4.988	0.723	4.56×10^4	4.659	0.828	6.18×10^3	3.791	1.158
8	SHOWER	1.60×10^6	6.205	0.212	1.11×10^6	6.045	0.235	2.65×10^4	4.423	0.717
9	SHOWER	3.35×10^6	6.526	0.141	3.24×10^6	6.510	0.150	7.00×10^4	4.845	0.579

Note: 1 each crew typically collected 8 samples from each fixture
2 only 2 samples were collected

TABLE 3.2: SUMMARY OF BACTERIOLOGICAL RESULTS OF ON BOARD SAMPLING, BY FIXTURE, CREW, AND BOAT[1]

Crew	Boat	FECAL COLIFORMS Geo. Mean Concentration (/100ml)	FECAL COLIFORMS Mean of Log	FECAL COLIFORMS Variance of Log	E. COLI Geo. Mean Concentration (/100ml)	E. COLI Mean of Log	E. COLI Variance of Log	PSEUDOMONAS AERUGINOSA Geo. Mean Concentration (/100ml)	PSEUDOMONAS AERUGINOSA Mean of Log	PSEUDOMONAS AERUGINOSA Variance of Log
GALLEY SINK										
1	HOUSE	1.40×10^7	7.146	0.662	1.07×10^7	7.028	0.918	9.42×10^2	2.974	0.590
2	HOUSE	6.54×10^8	8.816	0.148	2.68×10^8	8.428	0.152	1.71×10^4	4.234	2.835
3	HOUSE	1.94×10^8	8.287	0.292	6.14×10^7	7.789	0.406	1.00×10^4	4.000	0.286
4	POWER	6.19×10^7	7.792	0.756	5.30×10^7	7.724	0.654	3.51×10^5	5.545	2.198
5	POWER	1.16×10^7	7.064	0.185	9.35×10^6	6.970	0.159	2.20×10^5	5.343	2.820
6	POWER	1.92×10^7	7.282	2.313	1.49×10^7	7.173	2.168	1.68×10^6	6.226	0.684
7	SAIL	6.28×10^4	4.798	7.213	4.56×10^4	4.660	7.192	1.51×10^4	4.180	1.053
8	SAIL	2.16×10^7	7.335	1.369	1.20×10^7	7.079	1.700	9.13×10^3	3.961	1.825
9	SAIL	6.20×10^7	7.792	0.144	5.96×10^7	7.776	0.153	1.13×10^4	4.052	0.157
HEAD SINK										
1	HOUSE	2.99×10^6	6.476	1.787	2.24×10^6	6.349	1.637	1.09×10^3	3.037	0.780
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7	SAIL	1.44×10^5	5.159	1.012	7.91×10^4	4.898	1.442	1.85×10^3	3.267	0.643
8	SAIL	2.10×10^6	6.323	0.629	1.19×10^6	6.075	0.519	4.50×10^5	5.653	0.520
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SHOWER										
1	HOUSE	1.23×10^6	6.088	1.279	4.56×10^5	5.659	1.431	1.86×10^2	2.269	0.437
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3	HOUSE(2)	4.69×10^5	5.671	0.001	4.53×10^5	5.656	0.002	3.00×10^4	4.476	1.856
4	POWER	2.48×10^6	6.394	0.557	2.14×10^6	6.331	0.411	2.43×10^6	6.385	0.345
5	POWER	1.69×10^6	6.228	0.584	1.63×10^6	6.213	0.585	6.00×10^4	4.778	0.633
6	POWER	1.90×10^6	6.279	1.203	1.64×10^6	6.215	1.132	6.67×10^5	5.824	2.100
7	SAIL	9.74×10^4	4.988	0.723	4.56×10^4	4.659	0.828	6.18×10^3	3.791	1.158
8	SAIL	1.60×10^6	6.205	0.212	1.11×10^6	6.045	0.235	2.65×10^4	4.423	0.717
9	SAIL	3.35×10^6	6.526	0.141	3.24×10^6	6.510	0.150	7.00×10^4	4.845	0.579

Note: 1 each crew typically called 8 samples from each fixture
2 only 2 samples were collected

FIGURE 3.1
FECAL COLIFORM RESULTS

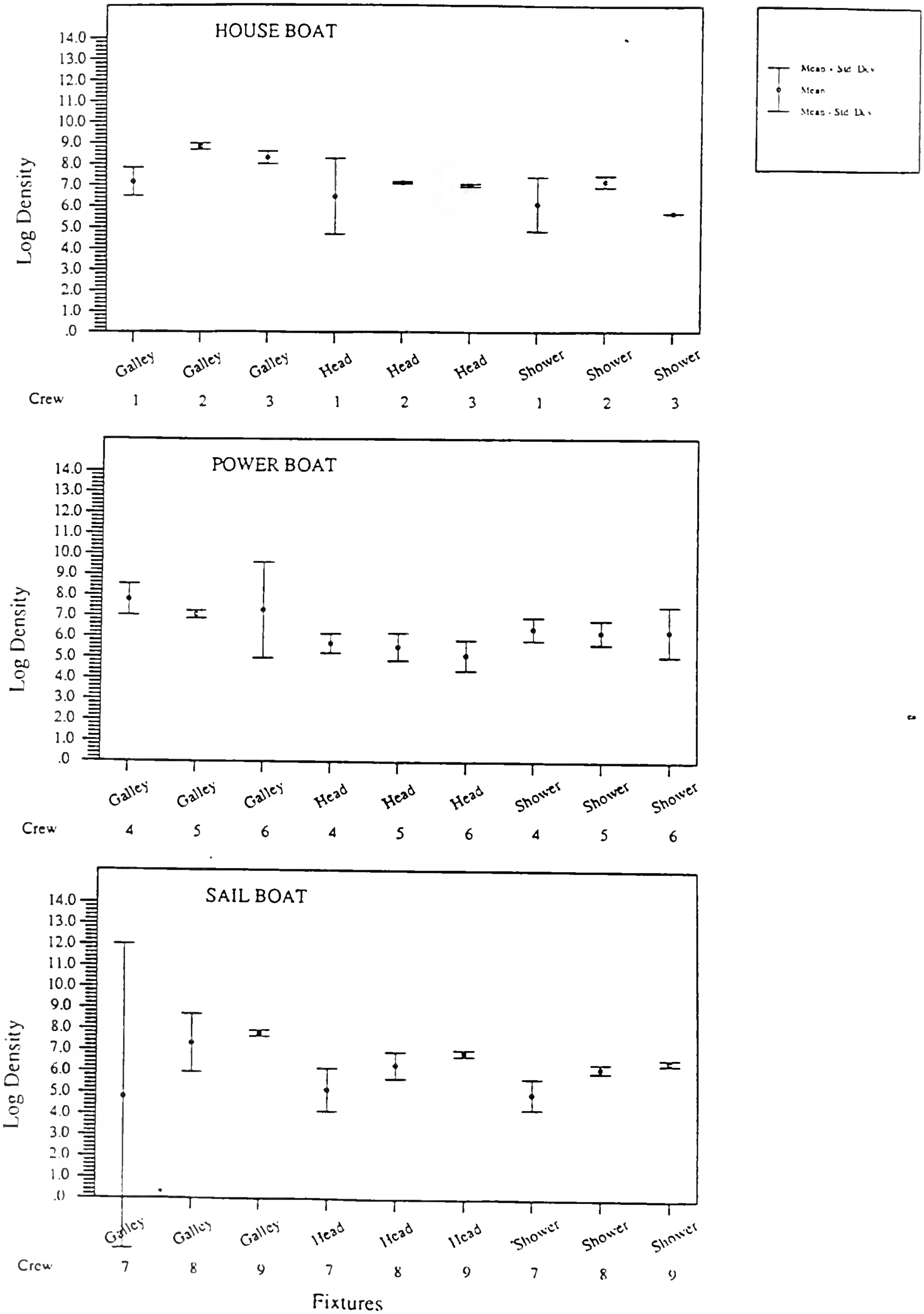
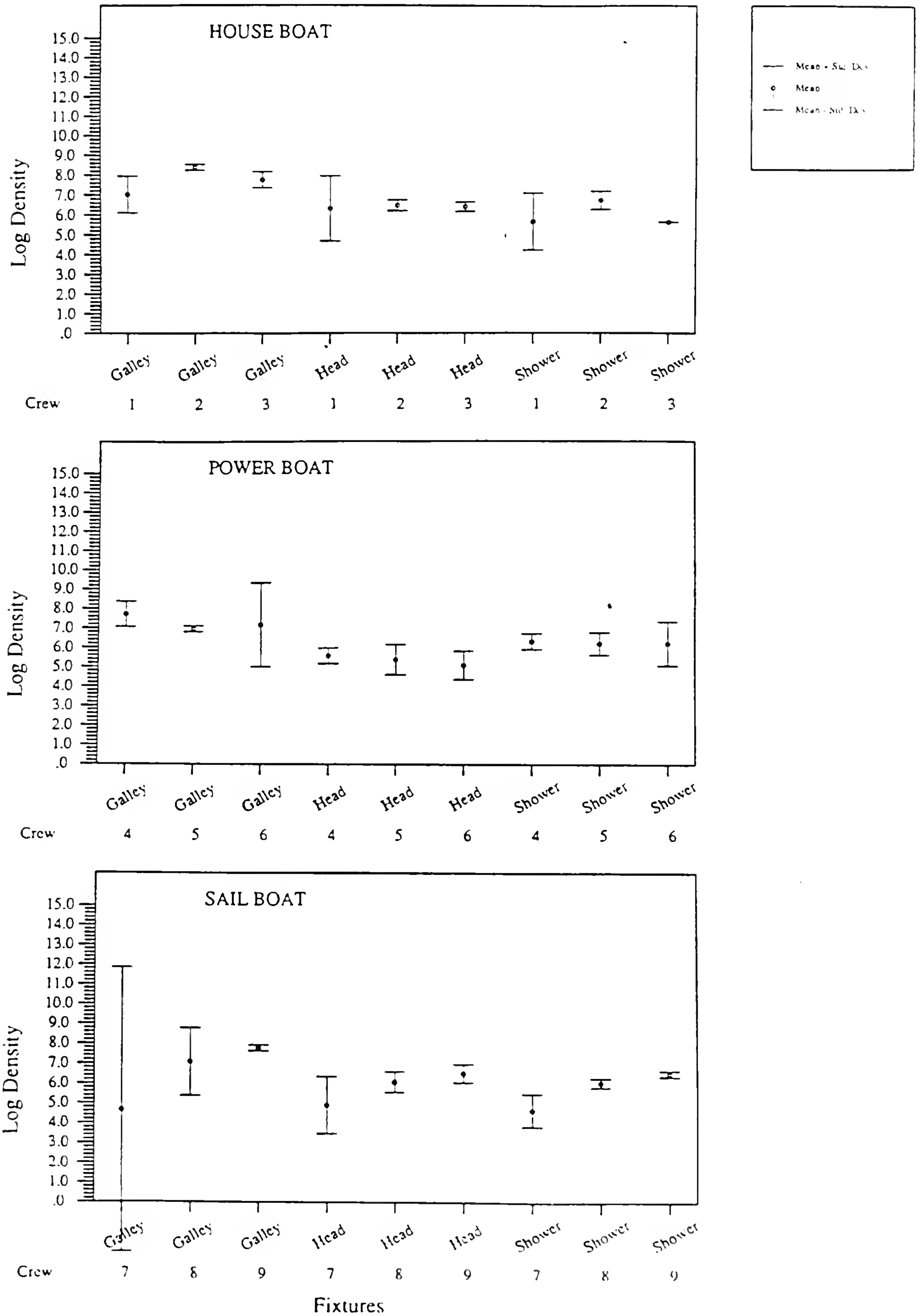


FIGURE 3.2
ESCHERICHIA COLI RESULTS



As expected, the reported E. coli densities were slightly less than the fecal coliform densities. The E. coli data exhibited the same general trend as the fecal coliforms data with the galley sink water having the highest apparent density and the shower water being the lowest (Figure 3.2). As in the case of the fecal coliforms data, the differences between the various fixtures and boats was not distinct.

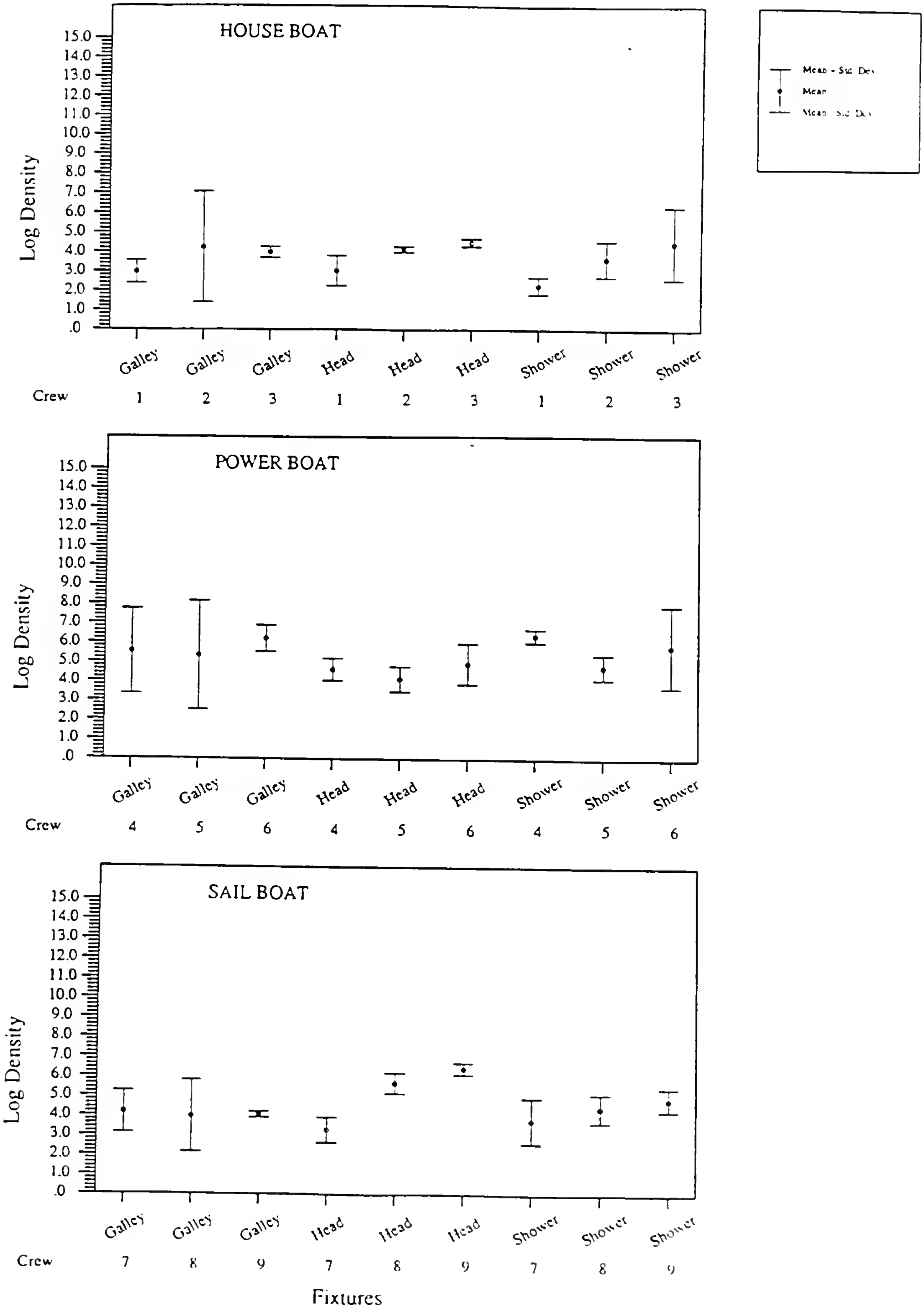
Pseudomonas aeruginosa (P aeruginosa) is an opportunistic pathogen which is known to cause eye and ear infections in swimmers. The densities measured in the grey waters (10^3 to 10^6 organisms per 100 ml) represent high values when compared to normally occurring environmental densitities which are typically less than 50 organisms per 100 ml. Visual inspection of the P aeruginosa results did not suggest any relationship among the various factors identified above for the other two species (Figure 3.3).

The onboard sampling program was designed to determine the effects of three factors on grey water quality: type of boat (house, power, sail), crew lifestyle, fixture type (shower, head sink, galley sink). As discussed above, crews were chosen to represent a variety of lifestyles from families with young children to groups of adults. However, unlike the differences in boats and fixtures which are physically distinct, crew types are less easily defined due to the continuum of lifestyles. The variability in greywater quality due to crew type may mask the effects of boat type and fixture type.

To account for the effects of all the variables in the design of the study, the grey water quality data were subjected to a sequence of nested ANOVA analyses in which the variability of the data was partitioned amongst the design variables (boats, crews and fixtures). In all cases the data were log transformed and the effects of the design variables were tested for statistical significance at the 95 percent confidence level.

This procedure is designed to determine which, if any, of the above three factors contributed significantly to the variability of the data set. By implication significant factors might be considered for regulatory action if the discharge to the receiving water is found to be harmful. Tests were carried out on the fecal coliform values only since these are at present the bacteriological water quality indicators in the MOE "Blue Book" for water used for recreational purposes.

FIGURE 3.3
PSEUDOMONAS AERUGINOSA RESULTS



Results of the ANOVA analysis indicated that variations in grey water quality between crews within boats were significant. Thus, crew selection could have confounded observed effects of boats and fixtures. While contributing significantly to the variability of the data, the lifestyle of the crews is a factor which is beyond regulatory control. The analysis further showed that there was a significant interaction between boats and fixtures with no single worst fixture or worst boat type. To illucidate this interaction, a series of one way analyses was performed.

The results of the one way comparisons between fixtures for each boat indicated that in the houseboat and the power boat, the galley sink exhibited the highest population density. In the sail boat the densities in all three fixtures were not significantly different. These results suggest that although the galley sink may be the largest contributor on some boat types, the trend is not constant across boats. Similarly, the relationship between the densities of the fecal coliforms in the head sink and the shower does not exhibit a constant pattern.

The results of the one-way comparisons between boats for each fixture indicated that the galley sink bacterial densities were highest in the house boat, with power and sail boats following in that order. However, for the head sink, the house boat densities were found to be highest, with the sail boat and the power boat following in that order. No significant difference was found among boats in the densities exhibited by shower water.

The log (10) mean fecal coliforms density across all boats and fixtures was 6.74, the corresponding log (10) variance was 1.20.

3.1.3 Water Usage

To determine the effects of pollutants on the receiving water, it is necessary to determine the loading of the contaminants discharged. For loading calculations, both concentration and flow data are required. This project included a component to determine the fresh water usage on the three pleasure boats studied.

In general, it may be assumed that all of the water supplied to the boat is eventually discharged as grey water, since losses due to drinking and cooking are minimal. Therefore, by measuring the volume of the water supplied, the total amount of grey

water produced can be estimated. This was done using a portable water meter connected to the supply hose during filling. Records were maintained by each of the crews on the volume of water supplied to the on board tanks during the period of the study.

Water use data were collected by each of the crews on the boats. Considerable variation in the water use was observed with the houseboat showing the lowest per capita usage in relation to the power and sail boats (Table 3.3). This may be attributable to either the lifestyles of the crews, but is more likely the result of limited water availability due to small water tanks on the houseboat used in the study. The actual volume of the tank was not available but supply was sufficiently limited to warrant one crew using purchased water in separate containers. Typical houseboat water use may therefore be higher than reflected in Table 3.3. Based on lifestyle considerations, BEAK believes that a value of 21 litres per person per day would be more typical for this type of boat.

Difficulties encountered with the equipment designed for the determination of the black water volumes prevented the collection of quantitative data on the volume of black water used on the boats by direct measurement. However, using pumpout frequencies, holding tank volumes and numbers of persons on board, an average black water generation rate of 10 litres per person per day was estimated. Based on these results, the rate of grey water production is in the range of 1.5 to 2 times the rate of black water production.

3.1.4 Grey Water Chemical Characteristics

Samples collected from the boat fixtures were analysed for nine chemical and biochemical parameters to determine the concentrations of conventional contaminants and nutrients in the grey water (Table 3.4).

In summarizing the results, arithmetic means were calculated for the boats and the fixtures (Table 3.5). It is clear from the values shown in the table that the grey water contains high concentrations of total and suspended solids, ammonia, total Kjeldahl nitrogen and the phosphorus species when compared with the concentrations typically observed in raw domestic sewage. These high concentrations are commensurate with the fact that water use is reduced on pleasure boats because of the limited supply and because there is less to no dilution water from other household sources. It is also

TABLE 3.3: FRESH WATER USAGE RESULTS
(litres/person/day)

Crew	House Boat	Power Boat	Sail Boat
1	4.8	13.1	13.3
2	-	31.8	-
3	6.9	20.1	19.9
Mean	5.9	21.7	16.6

TABLE 3.4: GREY WATER CHEMICAL CHARACTERIZATION

Sample Location	Total Phosphorus (mg/l)	Soluble Phosphorus (mg/l)	Total Solids (mg/l)	Suspended Solids (mg/l)	BOD5 (mg/l)	COD (mg/l)	TOC (mg/l)	Ammonia-N (mg/l)	TKN (mg/l)
SAILBOAT									
GALLEYSINK	1	0.26	710	100	180	1320	175	0.03	6.3
GALLEYSINK	3.7	3.2	870	116	300	1105	200	7.15	45
GALLEYSINK	1.12	0.83	2100	61	168	520	140	0.07	10.1
HEADSINK	1.015	0.65	400	74.5	120	250	30	0.02	4.5
HEADSINK	0.64	0.35	270	140	32	350	21	0.01	2.8
HEADSINK	1.65	1.09	350	210	60	230	35	0.11	6.9
SHOWER	0.194	0.004	330	142	41	330	9	3	5.9
SHOWER	0.3	0.005	290	146	21	345	10	0.53	2.9
SHOWER	0.49	0.005	510	148	9.9	920	70	1.17	9.3
MEAN CONC.	1.12	0.71	647.78	126.39	103.54	596.67	76.67	1.34	10.52
STANDARD ERROR OF MEAN	0.336	0.318	182.674	14.074	30.505	128.714	23.563	0.750	4.255
POWERBOAT									
GALLEYSINK	8.6	6.3	3800	2300	1360	2600	1330	21	51
HEADSINK	1.18	0.76	5800	138	120	340	73	0.01	6.5
SHOWER	1.38	1.02	305	37	42	117.5	22	9.9	17.4
GALLEYSINK	27	27	2600	520	920	2100	1100	35	172
HEADSINK	0.98	0.35	620	220	230	390	100	0.03	5.2
SHOWER	5.45	4.3	650	330	129	550	50	2.9	23/22
GALLEYSINK	24	25	3300	2000	1090	3700	880	2.5	90
HEADSINK	1.72	1.1	660	380	220	650	180	0.01	16.8
SHOWER	8.3	5.9	530	106	102	290	70	90	90
MEAN CONC.	8.73	7.97	2029.44	670.11	468.11	1193.06	422.78	17.93	49.89
STANDARD ERROR OF MEAN	3.139	3.293	611.400	268.795	159.337	402.771	164.81	9.287	18.138
HOUSEBOAT									
GALLEYSINK	16.3	15.1	4100	570	2600	4000	1920	4	117
GALLEYSINK	2.4	1.66	670	188.5	590	620	345	0.1	23
HEADSINK	0.038	0.014	148	11.5	60	67	7	0.05	0.34
HEADSINK	0.38	0.005	610	280	140	650	50	13.7	33
SHOWER	0.112	0.004	210	17.6	12.4	87	13.5	2	8.7
SHOWER	0.86	0.24	650	290	430	760	190	3.2	24
GALLEYSINK	14.4	13.9	7700	2800	410	8900	6100	22	155
HEADSINK	4.1	2.4	1390	830	320	850	320	0.05	33
SHOWER	0.27	0.126	510	182	69	470	68	0.72	8.1
MEAN CONC.	4.32	3.72	1776.44	574.40	514.60	1822.67	1001.50	5.09	44.69
STANDARD ERROR OF MEAN	2.015	1.942	795.046	274.783	253.574	913.891	629.857	2.407	15.913

important to consider that the values quoted in the table for domestic sewage are indicative of the observations at the inlet to a sewage treatment plant and therefore are inclusive of dilution by infiltration and industrial sources.

The significance of these concentrations on the receiving waters can be determined by identifying the loading which might be expected from boats. Using an assumed split of water use by fixture and estimates of the water use on each of the types of boats, the daily loading of each contaminant was calculated. These loadings were seen to be quite low and typically amount to less than 0.1 kilograms per day (Table 3.6).

3.2 Instream Sampling

3.2.1 General

The program of receiving water sampling carried out in this study was designed to quantify the effects of grey water discharges to the selected embayments (Chapter 2.0). The sampling locations were chosen because of their enclosed geography and their probable use by recreational boats. Agencies (MOE, MNR, Parks Canada) with knowledge of the locally popular anchorages in the South Georgian Bay and Central Trent Canal areas were consulted for assistance in selecting the sites.

Two sites in Southern Georgian Bay and one site in the Trent system were selected. In Georgian Bay both sites (Frying Pan Bay and Lost Bay) were located on the northern end of Beausoleil Island, approximately 20 kilometers from Midland (Figure 2.1). Each embayment is enclosed by headlands and is surrounded by essentially undeveloped land (Lost Bay has some limited cottage development on the western head land). The Trent Canal site (Blind Channel - Figure 2.2) was chosen based on information which indicated that it was frequently used as an anchorage by passing houseboats and because of its proximity to a boat launching site. The surrounding land was mainly agricultural or undeveloped.

3.2.2 Sample Collection

As discussed in Section 2.0 samples were collected on a pre-determined schedule at each of the instream sampling locations. Samples were collected in the morning and evening

TABLE 3.5: MEAN VALUES GREY WATER CHEMICAL AND BIOCHEMICAL CHARACTERISTICS

Sample Location	Total Phosphorus	Soluble Phosphorus	Total Solids	Suspended Solids	BOD_5	COD	TOC	Ammonia-N	TKN
	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
BY BOAT									
Sail Boat	1.12	0.71	648	126	104	597	77	1.3	11
Power Boat	8.73	8.0	2029	670	468	1193	423	18	50
House Boat	4.32	3.7	1776	574	515	1823	1002	5.1	45
BY FIXTURE									
Galley Sink	11	10.4	2872	962	846	2763	1354	10.2	74
Head Sink	1.30	0.75	1139	254	145	420	91	1.6	12
Shower	1.93	1.3	443	155	95	430	55	12.6	18.5
RAW SEWAGE[1]									
High	15	10	1200	350	400	1000	290	50	75
Low	4	3	350	100	110	250	80	12	20

1 Waste Water Engineering: Treatment Disposal Re-use Metcalf & Eddy, 1979

TABLE 3.6: GREY WATER DISCHARGE LOADINGS

SAMPLE SOURCE	PER CAPITA WATER USE (1/c/d)	NUMBER OF PERSONS	TOTAL PHOSPHORUS (kg/d)	SOLUBLE PHOSPHORUS (kg/d)	TOTAL SOLIDS (kg/d)	SUSPENDED SOLIDS (kg/d)	BOD_5 (kg/d)	COD (kg/d)	TOC (kg/d)	AMMONIA-N (kg/d)	TKN (kg/d)
BY BOAT											
SAIL BOAT	17	4	0.0004	0.0004	0.1216	0.0387	0.0321	0.1058	0.0474	0.0006	0.0030
POWER BOAT	22	4	0.0005	0.0005	0.1590	0.0506	0.0419	0.1383	0.0620	0.0008	0.0039
HOUSE BOAT	20	6	0.0008	0.0007	0.2198	0.0700	0.0580	0.1913	0.0857	0.0010	0.0054

Saturday, Sunday and Monday on two weekends. One of these weekends coincided with the August 1 long weekend and reflected a high boat traffic situation. The second weekend, August 8, could be considered a normal summer period weekend for boat traffic.

Samples were collected from the water surface at a depth of approximately 1 metre from 10 stations located over the entire area of the embayments. In addition, a background location was selected away from the anchorage area so that the unaffected bacterial density could be determined.

Drogues were deployed during the sampling events to identify the presence of currents. In all three embayments the drogue behaviour indicated the presence of low velocity currents but significant exchange flow relative to the volumes of the embayments.

The number of boats of each variety was enumerated during each sampling event and is presented in Table 3.7. Unfortunately it was not possible to determine the presence of a shower fixture by visual external inspections, hence sailboats and power boats were not distinguished between types A and B. The table shows that boat usage of Blind Channel was relatively light when compared to Lost Bay and Frying Pan Bay. As expected, all three locations in the second weekend of sampling were less heavily used than the first.

3.2.3 Data Analysis

The instream bacterial population densities were determined on the samples collected in each of the sampling events for fecal coliform, E. coli and Pseudomonas aeruginosa (Appendix A). To characterize the water quality of each of the embayments during each of the sampling events, the geometric mean of the bacterial densities from all 10 embayment sampling points was used. It is standard practice to use a geometric mean since bacterial data is log normally distributed. In this way a single number was generated for use in subsequent analyses of the embayment data (Table 3.8). Also in the table are the values of the bacterial densities found at the background locations near the embayments. In general, these locations were chosen to be largely unaffected by the water quality of the embayment being sampled or any other anthropogenic sources of bacteria.

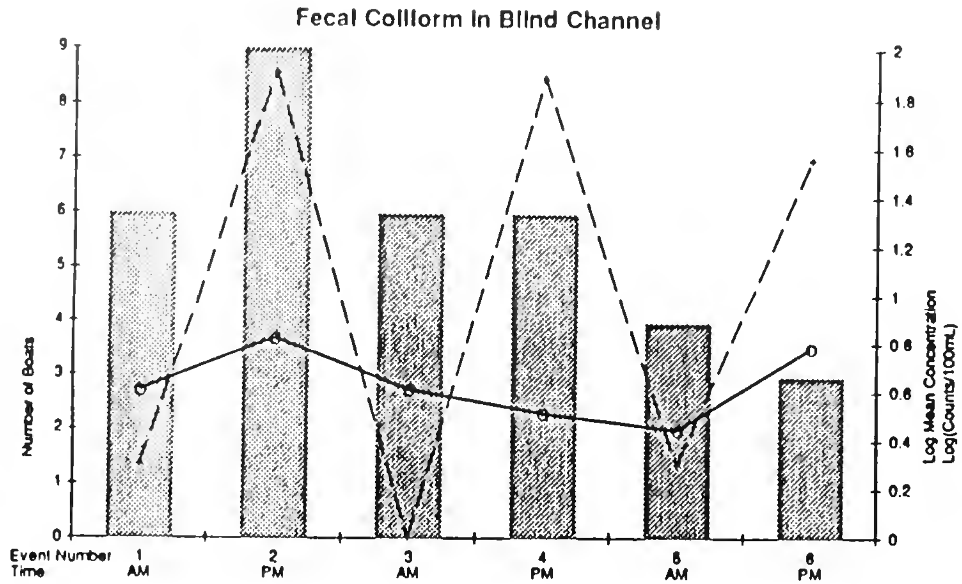
TABLE 3.7: BOAT USAGE WITHIN SAMPLED EMBAYMENTS

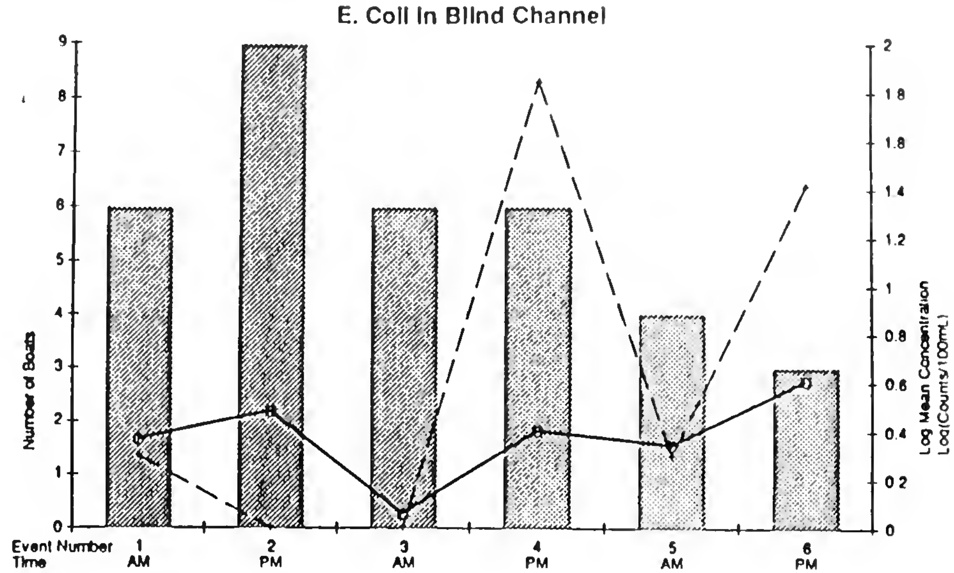
			BLIND CHANNEL				LOST BAY				FRYING PAN BAY			
Day	Sampling Time[1]	Event No.	House Boats	Power Boats	Sail Boats	Total Boats	House Boats	Power Boats	Sail Boats	Total Boats	House Boats	Power Boats	Sail Boats	Total Boats
Weekend 1														
Sat.	a.m.	1	5	1	0	6	2	5	5	12	0	19	1	20
Sat.	p.m.	2	5	2	2	9	2	8	12	22	1	19	5	25
Sun.	a.m.	3	5	1	0	6	3	5	24	24	0	23	3	26
Sun.	p.m.	4	3	3	0	6	2	5	24	24	0	20	7	27
Mon.	a.m.	5	3	1	0	4	2	6	24	24	1	27	8	36
Mon.	p.m.	6	3	1	0	3	0	2	3	3	0	10	4	14
Weekend 2														
Sat.	a.m.	7	3	0	0	3	0	4	6	10	3	13	5	21
Sat.	p.m.	8	3	0	0	3	0	10	18	28	0	28	5	33
Sun.	a.m.	9	3	0	0	3	0	8	18	26	0	21	4	25
Sun.	p.m.	10	6	0	0	6	0	3	3	6	0	9	6	15
Mon.	a.m.	11	6	0	0	6	0	2	1	3	0	6	4	10
Mon.	p.m.	12	3	1	0	4	0	3	4	7	0	10	2	12

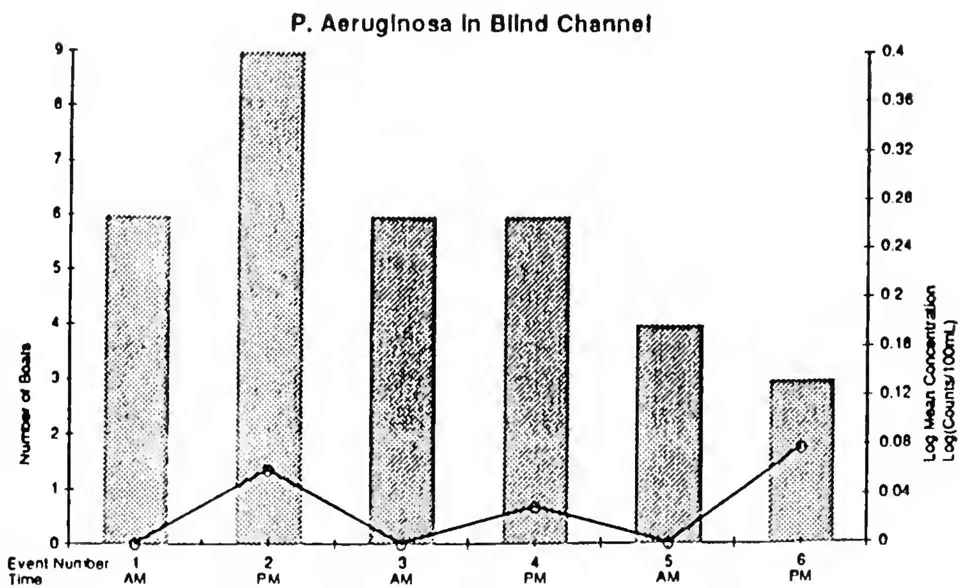
1 Sampling times were standardized as AM or PM. AM sampling was generally conducted between 08:00 and 09:00 hrs. PM sampling was generally conducted between 18:00 and 19:00 hrs.

TABLE 3.8: EMBAYMENT BACTERIAL ANALYSES

BLIND CHANNEL	FECAL COLIFORM		E. COLI		P. AERUGINOSA	
Event No.	Geometric Mean (#/100 ml)	Background (#/100 ml)	Geometric Mean (#/100 ml)	Background (#/100 ml)	Geomtric Mean (#/100 ml)	Background (#/100 ml)
1	4	2	2	2	1	1
2	7	80	3	1	1	1
3	4	1	1	1	1	1
4	3	76	3	70	1	1
5	3	2	2	2	1	1
6	6	36	4	26	1	1
7	1	2	1	2	1	1
8	2	1	2	1	1	1
9	2	1	2	1	2	1
10	1	1	1	1	1	1
11	1	2	1	2	1	1
12	2	2	1	2	1	2
FRYING PAN BAY						
1	51	4	17	1	54	9
2	163	1	81	1	37	48
3	293	2	108	1	89	41
4	189	28	45	28	21	44
5	203	10	71	10	16	2
6	360	29	204	20	9	1
7	50	7	29	6	1	1
8	90	19	26	3	505	400
9	103	6	47	4	38	220
10	75	4	21	2	171	60
11	64	6	21	2	328	1,180
12	89	34	44	15	88	220
LOST BAY						
1	7	2	4	2	23	2
2	7	2	3	2	49	42
3	109	2	74	2	214	56
4	91	34	59	17	14	7
5	105	2	57	2	17	2
6	40	2	38	2	1	1
7	35	2	18	2	2	2
8	31	48	15	10	213	200
9	23	1	15	1	20	77
10	23	2	17	1	232	210
11	13	2	9	2	140	1050
12	43	106	11	14	58	156







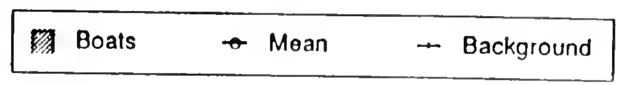


FIGURE 3.4
Blind Channel Results-
Weekend Number 1

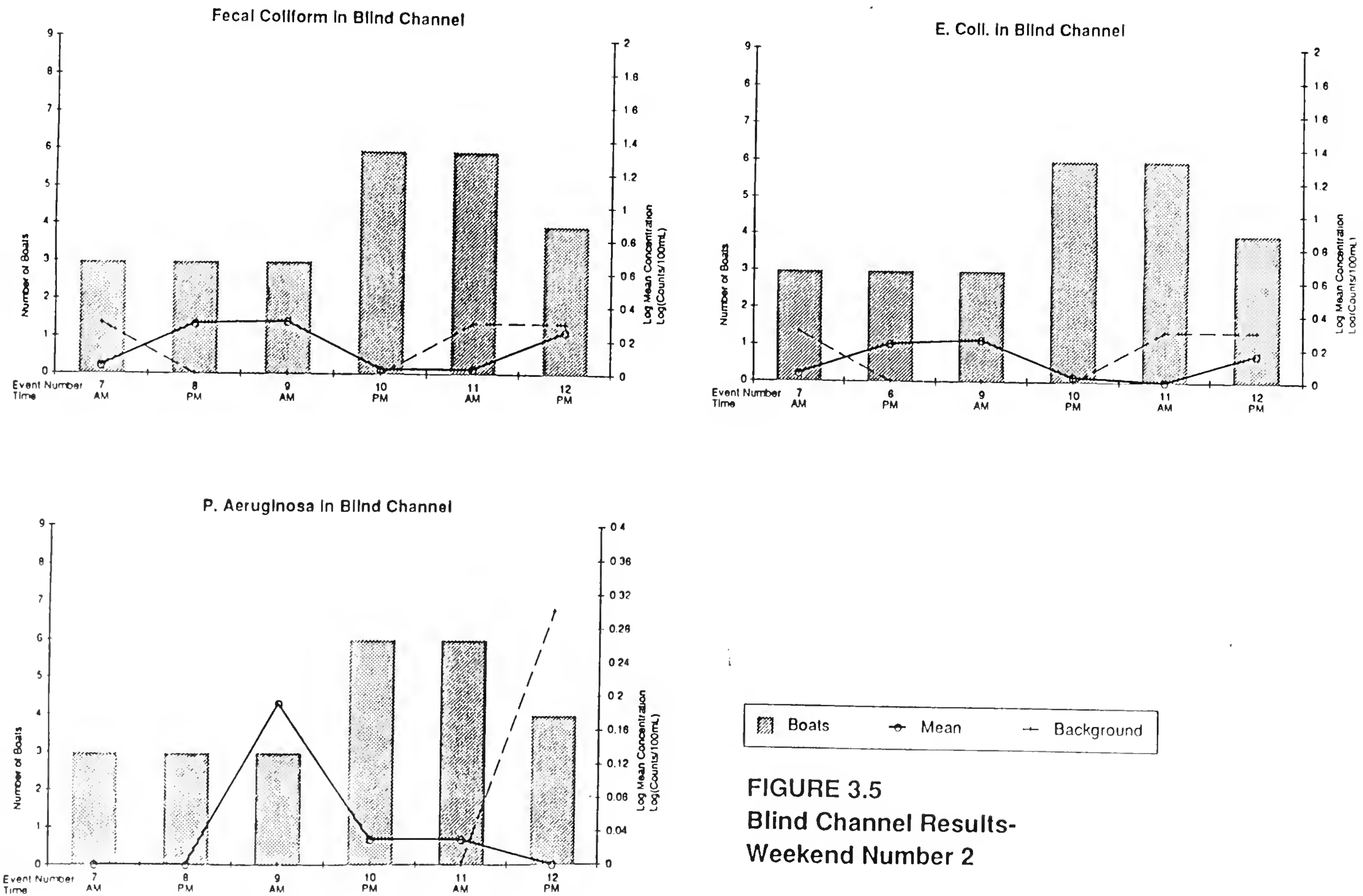


FIGURE 3.5
Blind Channel Results-
Weekend Number 2

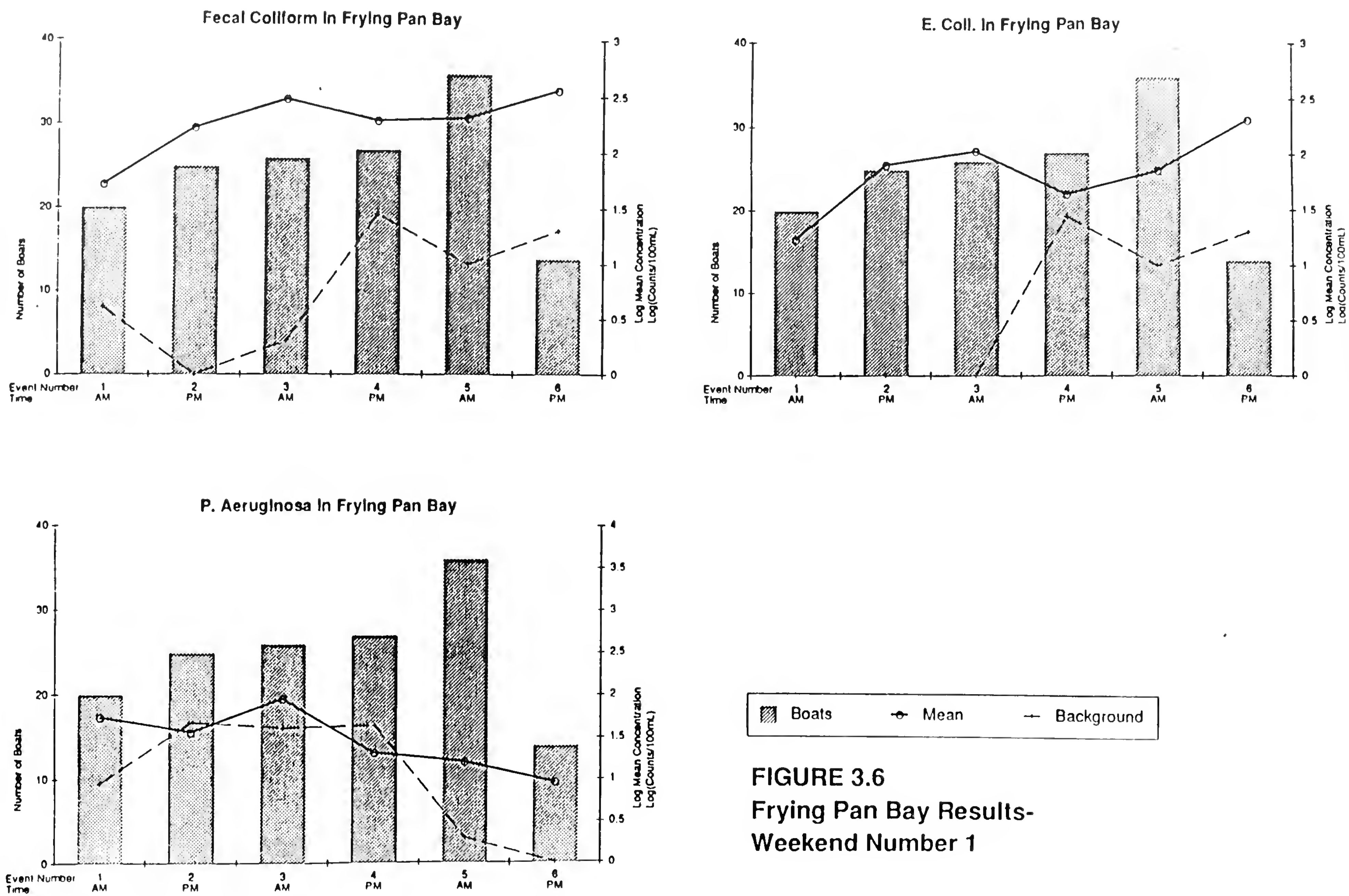


FIGURE 3.6
Frying Pan Bay Results-
Weekend Number 1

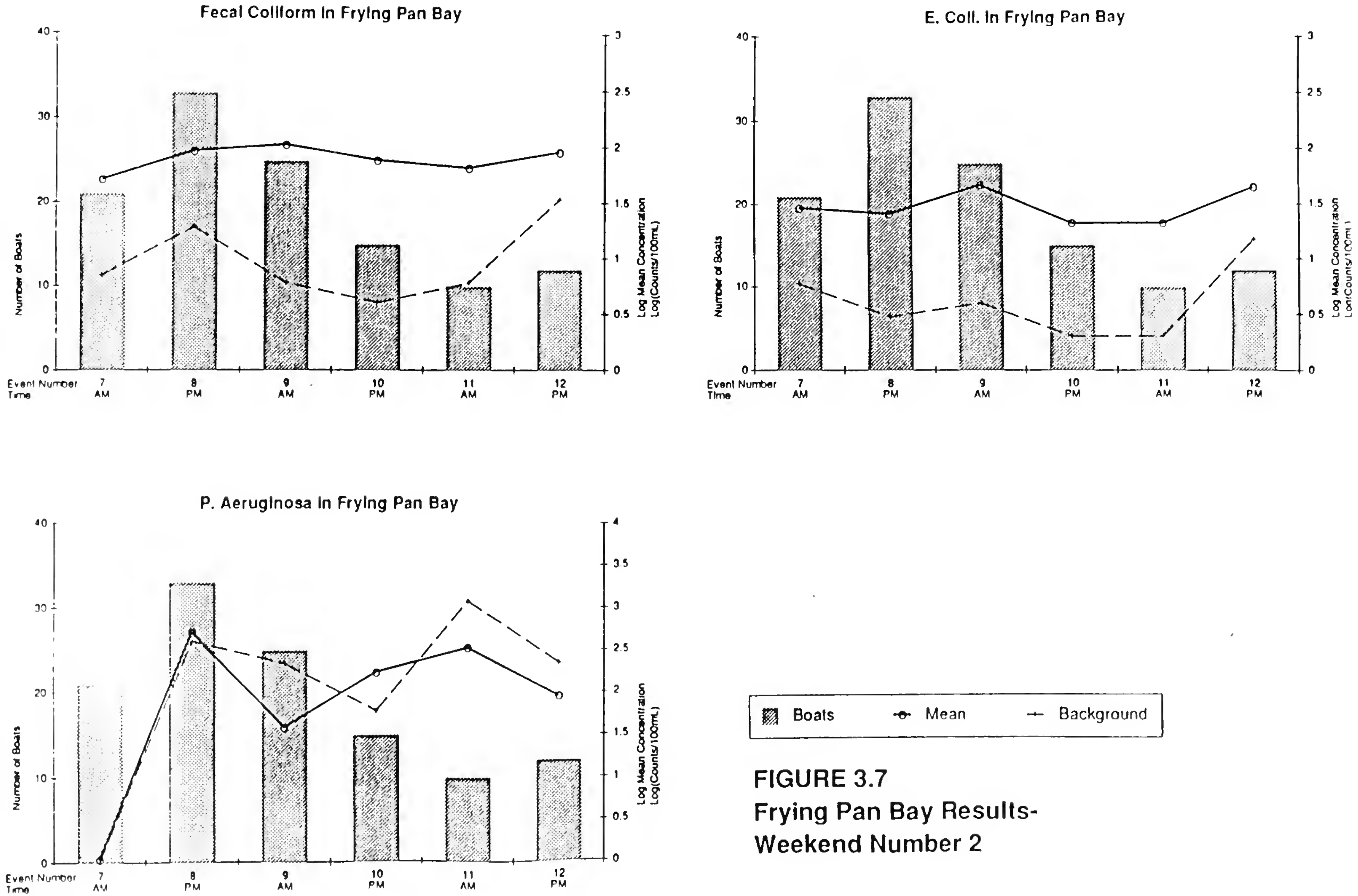
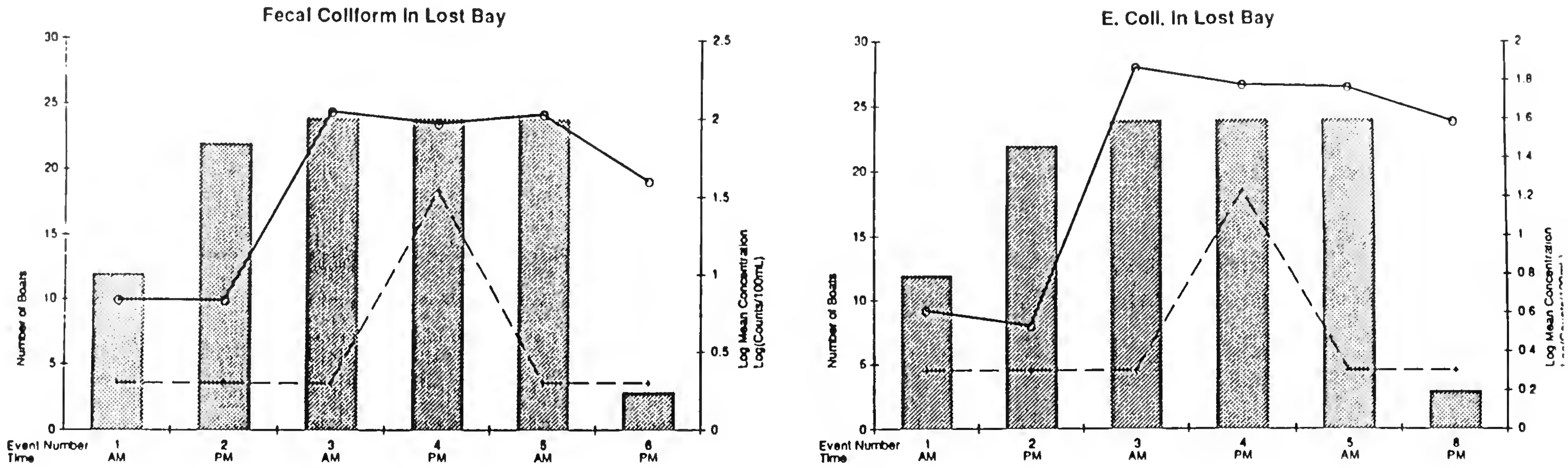
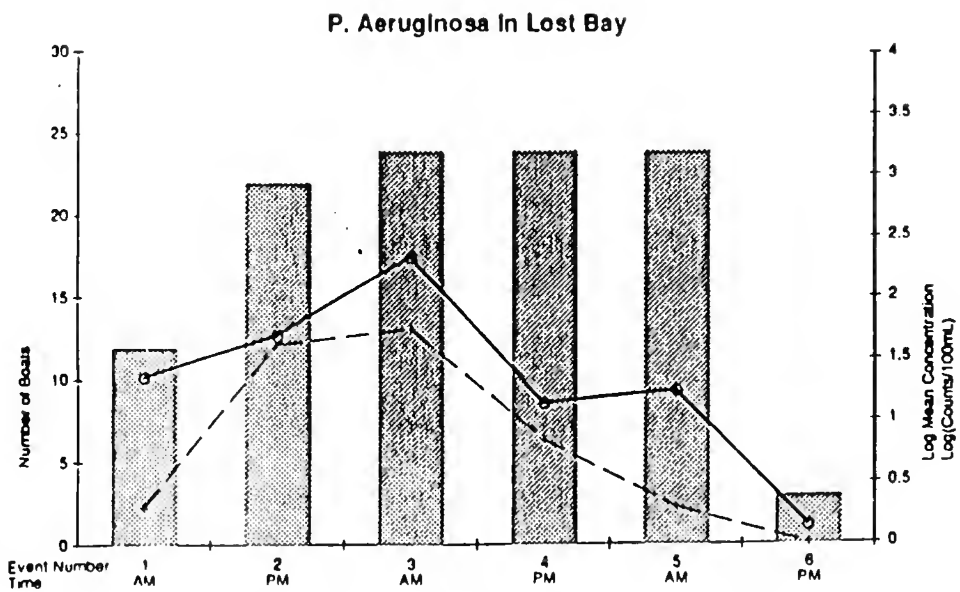


FIGURE 3.7
Frying Pan Bay Results-
Weekend Number 2





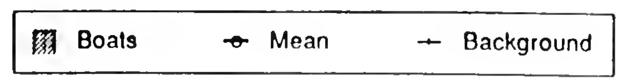


FIGURE 3.8
Lost Bay Results-
Weekend Number 1

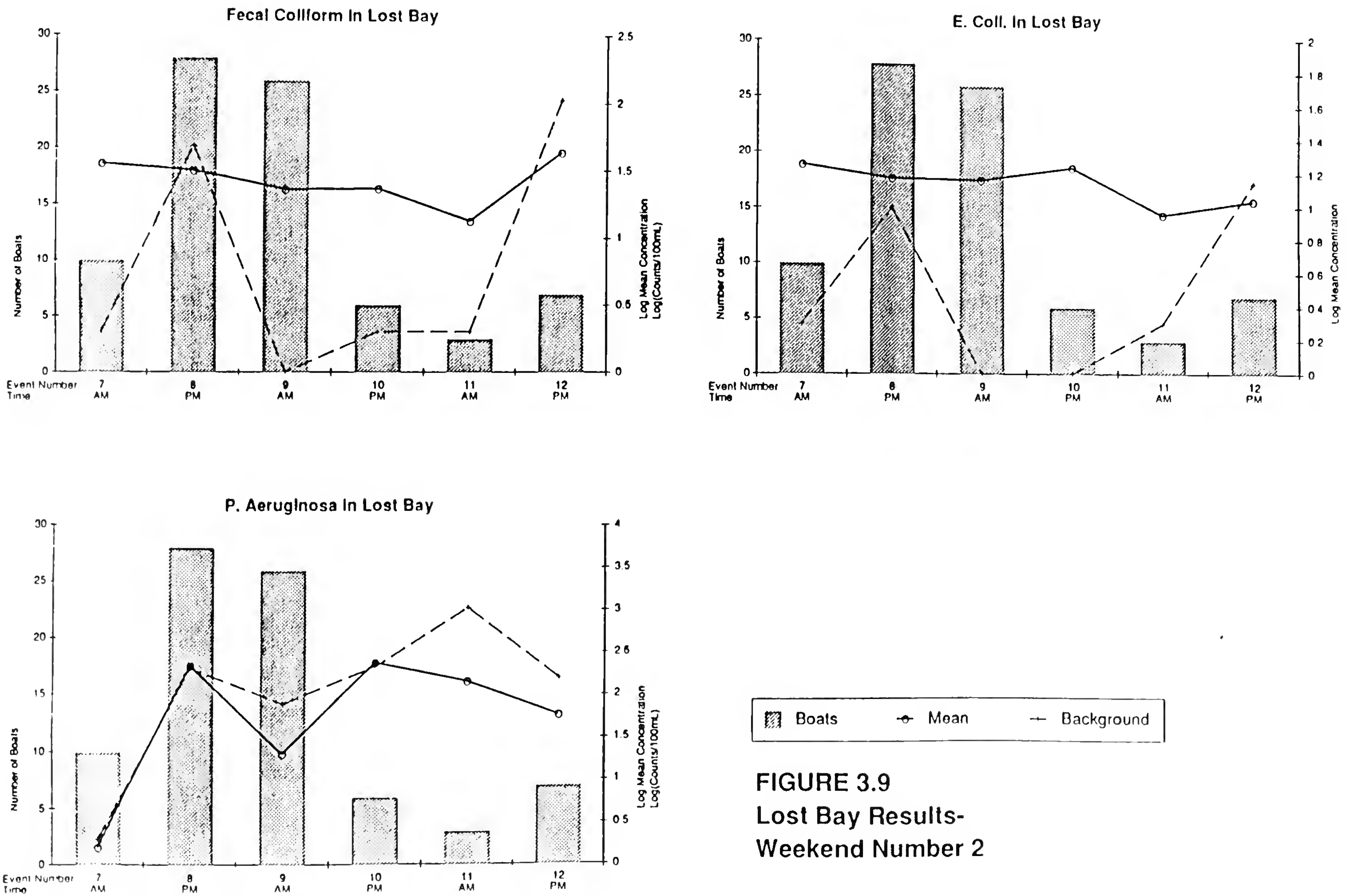


FIGURE 3.9
Lost Bay Results-
Weekend Number 2

The results of the embayment sampling were plotted along with the number of boats in the embayments at the time of the sampling, to determine the possibility of simple statistical relationships between the various bacteria and the number of boats (Figures 3.4 to 3.9). In Blind Channel there appears to be no relationship between the number of boats and the bacterial densities for any of the species tested. The density values were low and the background station values were erratic for the fecal and E. coli densities.

In Frying Pan Bay the densities for fecal coliform at times exceeded the MOE Blue Book recreational water quality guideline of 100 organisms per 100 ml on a series of samples. The highest values were found when many boats were present and therefore a relationship is suggested. Similarly, a relationship appears likely for the E. coli densities and the number of boats. This could be expected since E. coli frequently behave similarly to fecal coliform. In the case of both species however, the background densities drifted markedly making it difficult to draw any definitive conclusion.

The fecal and E. coli densities in Lost Bay behave in a similar fashion to those in Frying Pan Bay, especially during the first weekend. In addition, in Lost Bay the Pseudomonas aeruginosa densities suggest a relationship until the wide variation in the background station is considered. The wide variation in Pseudomonas aeruginosa data suggests that some other factors may be causing the observed fluctuations in the Pseudomonas aeruginosa density within the bay.

The previously discussed figures do not consistently demonstrate a reliable simple relationship between the number of boats in an embayment and the bacterial densities observed. In the figures which do suggest a relationship, the conclusion is confounded by the variance of the background results. To further explore the existence of simple statistical relationships between these results the log bacterial densities were correlated against the number of boats in the embayment at the time of sampling. Regressions were carried out on the fecal coliform results only, since the MOE Blue Book recreational water quality objective is formulated in terms of this group of organisms. The data suggests that the E. coli behaves in a fashion similar to the fecal coliform, suggesting that the results of a regression would be similar to that for fecals. The geometric mean densities of each of the bacteria species was correlated against the number of boats present in each embayment at the time of sample collection in an effort to determine if any simple statistical relationship existed between them.

FIGURE 3-10 BLIND CHANNEL FECAL COLIFORMS VS BOATS

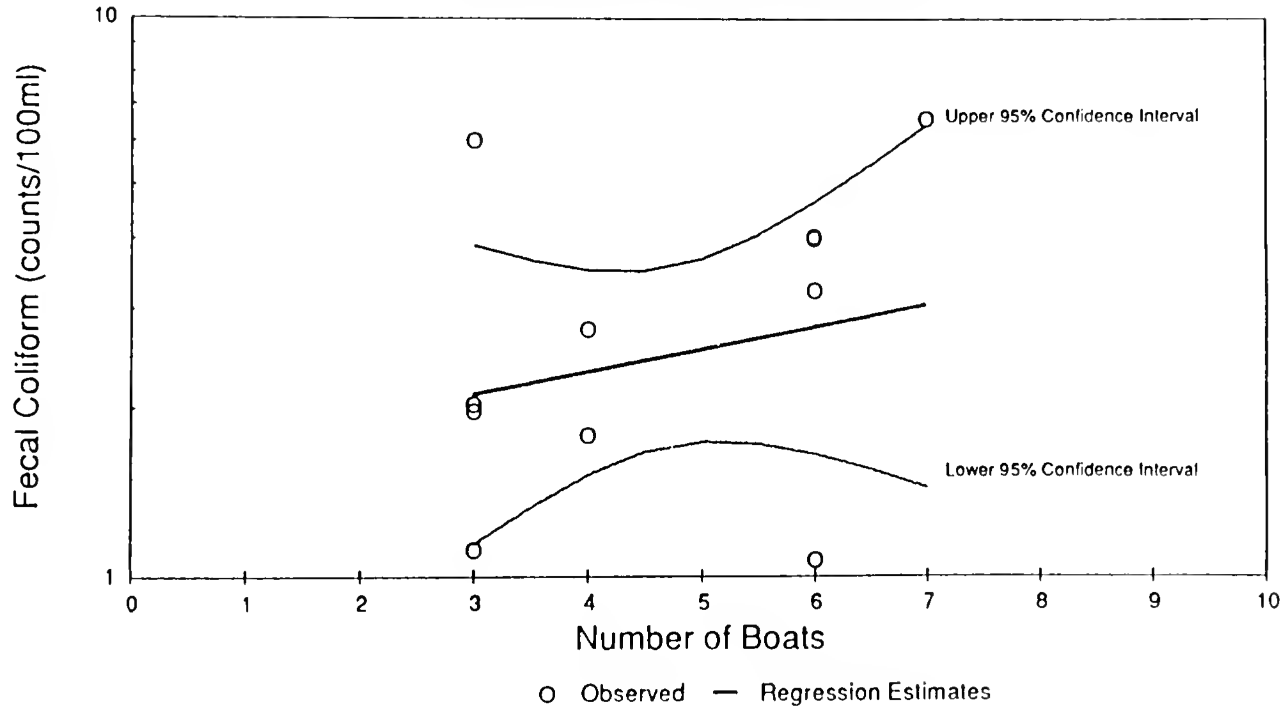


FIGURE 3-11 FRYING PAN BAY
FECAL COLIFORMS VS BOATS

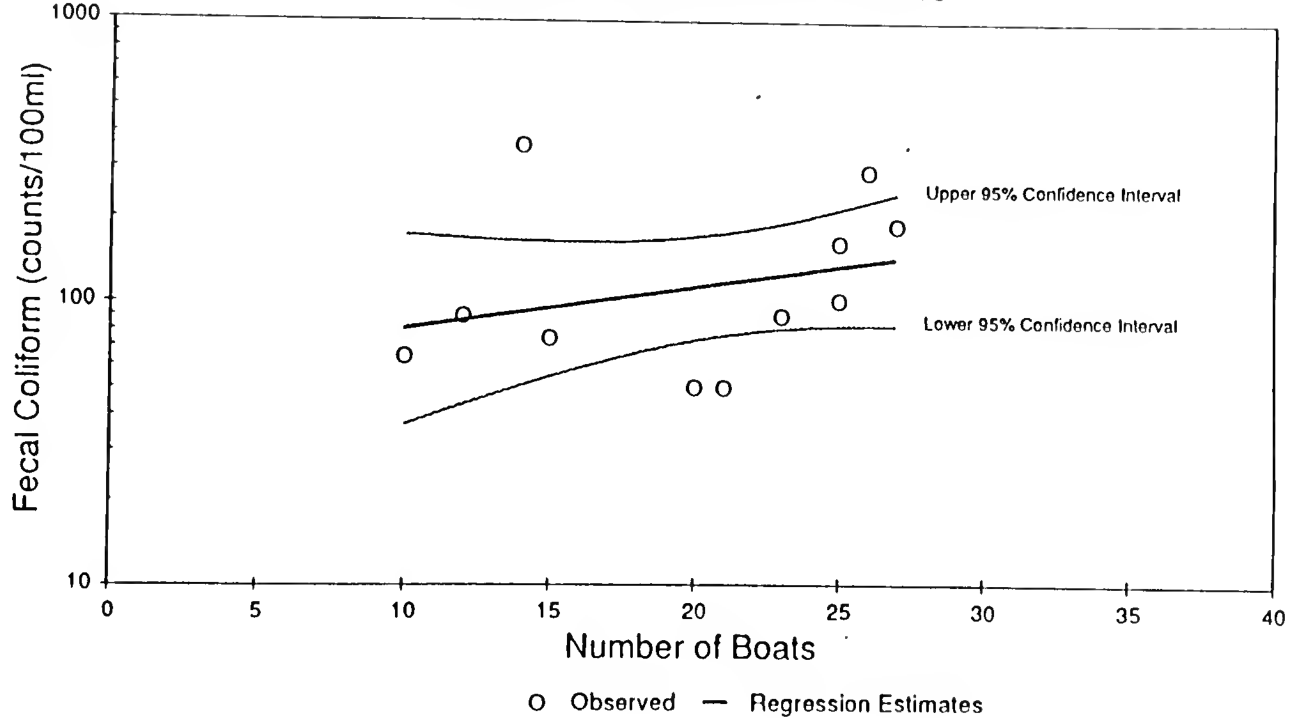
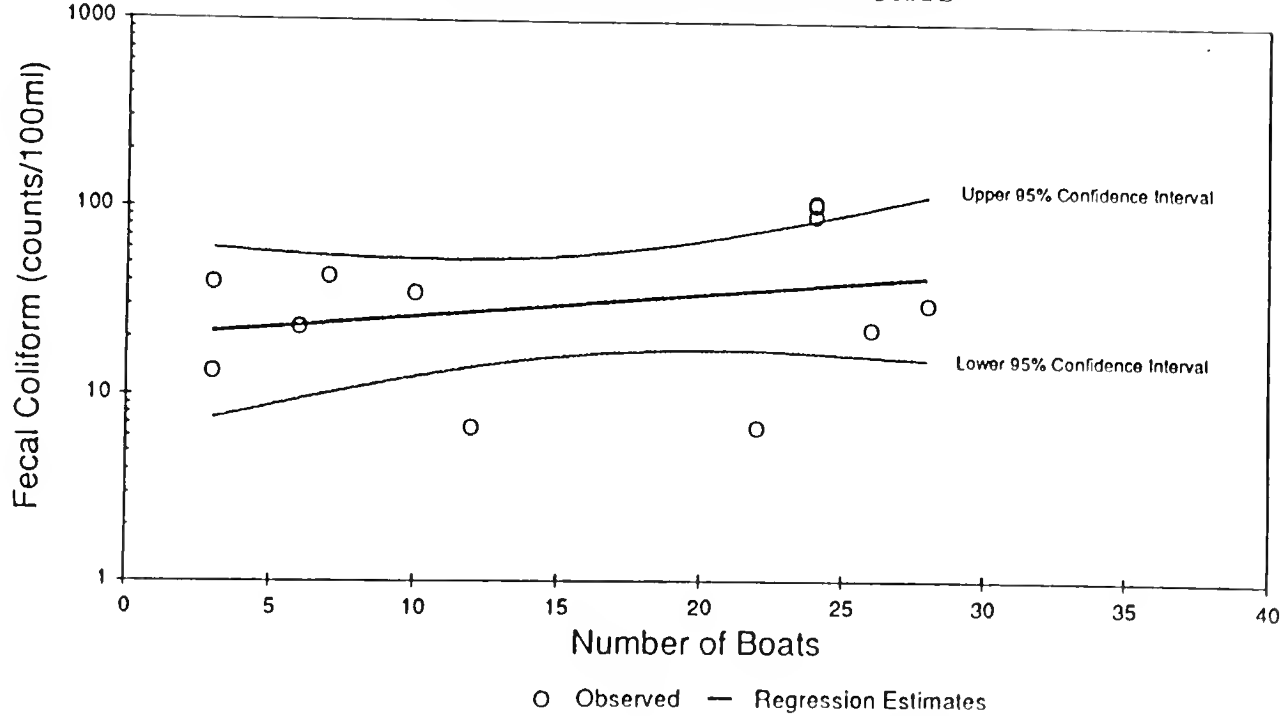


FIGURE 3-12 LOST BAY
FECAL COLIFORMS VS BOATS



The results of the regressions carried out on the fecal coliform data for the three embayments are shown in Figures 3.10 to 3.12. To determine the significance of the apparent relationships, the slopes were tested for significant difference from zero and the correlation coefficients were tested for significance. It was found that none of the slopes was significantly different from zero. This implies that a straight, horizontal line on the figures represents a suitable depiction of the relationship. That is, there is no statistical relationship between the two parameters. Similarly, the correlation coefficients calculated for E. coli and Pseudomonas aeruginosa were also found to be insignificant, implying that the bacterial densities and boat numbers were not related.

Based on simple statistical correlations of the embayment data, it appears appropriate to conclude that no simple relationship exists between the number of boats and the embayment water quality. Notwithstanding this, the data for Frying Pan Bay clearly suggests that fecal coliform densities increased during the two periods of sampling and that levels exceeded the recreational use water quality guideline at certain times.

3.2.4 Embayment Model

The statistical treatment described above attempted to account for all the variability in the embayment water quality as a function of the number of boats alone. That is, the effects of the temporal variation of the background bacterial concentration, the natural die-off of bacteria, the exchange associated with ambient water movements into and out of the embayments are implied by the above statistical procedures to be insignificant. In practice, it is probable that they are important in some situations. To account for the variability of bacteria densities in relation to these parameters it is necessary to make estimates of their effects. This can be done through exploratory modelling to identify whether or not they play an important role in determining the observed embayment bacterial densities.

To explore the relationship between boat density and bacterial water quality a deterministic model was developed relating surface water quality in the embayments to the volume of the embayment, the background bacterial water quality, exchange flow between the embayment and surrounding waters, bacterial die-off, and bacterial loadings due to boat activities. The model assumes that there is sufficient energy in the wind and exchange flow to induce lateral mixing of the surface water within the basin over a period of several hours. This assumption is born out by the drift drogue data which

showed net movements of up to several hundred metres over the course of a few hours. The only source of bacteria within the embayments was assumed to be the boats. This ignores any input from shore based activity, other water based sources (e.g., water fowl and mammals) and sediment bacterial processes which, although not measured in this study, are known to be non zero. Hence, the analysis is conservative relative to the impact of boat bacterial loadings.

The form of the model is as follows:

$$V\,dC/dt = Qe(Cb-C) - KVC + L \qquad (1)$$

where:

C	is the concentration of bacteria in the embayment at time t (cnts/100ml),
dC/dt	is the change in concentration of bacteria with time (cnts/100 ml/day)
V	is the volume of the embayment (m^3)
Cb	is the background concentration of bacteria (cnts/100ml)
Qe	is the exchange flow (m^3/day)
K	is the first order bacterial die-off coefficient (per day)
t	is the elapsed time (days)
L	is the loading of bacteria to the embayment (cnts/day)

Equation (1) may be solved to give the concentration in the embayment at any time (t) as a function of the parameters in the model.

The model was applied to both Frying Pan Bay and Lost Bay over the two three day sampling periods August 1,2,3 (Weekend 1); and August 8,9,10 (Weekend 2). The physical characteristics of volume and exchange flow were estimated from nautical charts and qualitative drogue data respectively. Background concentrations were assumed to be as measured during each of the daily AM and PM samplings. A value of 0.25 per day was assumed for the first order die-off coefficient. The following relationships were used to relate observed boat densities to an equivalent bacterial loading:

	log cnts/100ml
log mean grey water fecal coliform concentration over all boats and all fixtures	6.74
log standard error of grey water fecal coliform concentration over all boats and all fixtures	1.20

	cnts/100 ml
geometric mean fecal coliform concentration + standard error	8.8×10^7
geometric mean - fecal coliform concentration - standard error	3.5×10^5

Boat Type	Assumed Water Use (l/c/day)	Assumed No. People	Total Water Use (l/day)
Sail	16.6	4	66.4
Power	21.7	4	86.8
Houseboat	21*	6	126

* measured value of was 6 l/c/day but was thought to be unreliable as discussed in section 3.1.3 above, 21 l/c/day is, in Beak's estimate, a more reasonable estimate of consumption and is conservative for the purposes of modelling.

Using the above estimates of fecal coliform density (geometric mean +/- standard error) and the daily estimates of water use, estimates of fecal coliform loadings by boat were calculated using the following equation:

bacterial loading = (daily water use) x (bacterial density)

Boat	Maximum Load (cnts/day)	Minimum Load (cnts/day)
Sail	5.84×10^{10}	2.33×10^{8}
Power	7.64×10^{10}	3.04×10^{8}
Houseboat	1.11×10^{11}	4.42×10^{8}

overall maximum load, Lmax (cnts/boat/day) 1.11×10^{11}
overall minimum load, Lmin (cnts/boat/day) 2.33×10^{8}

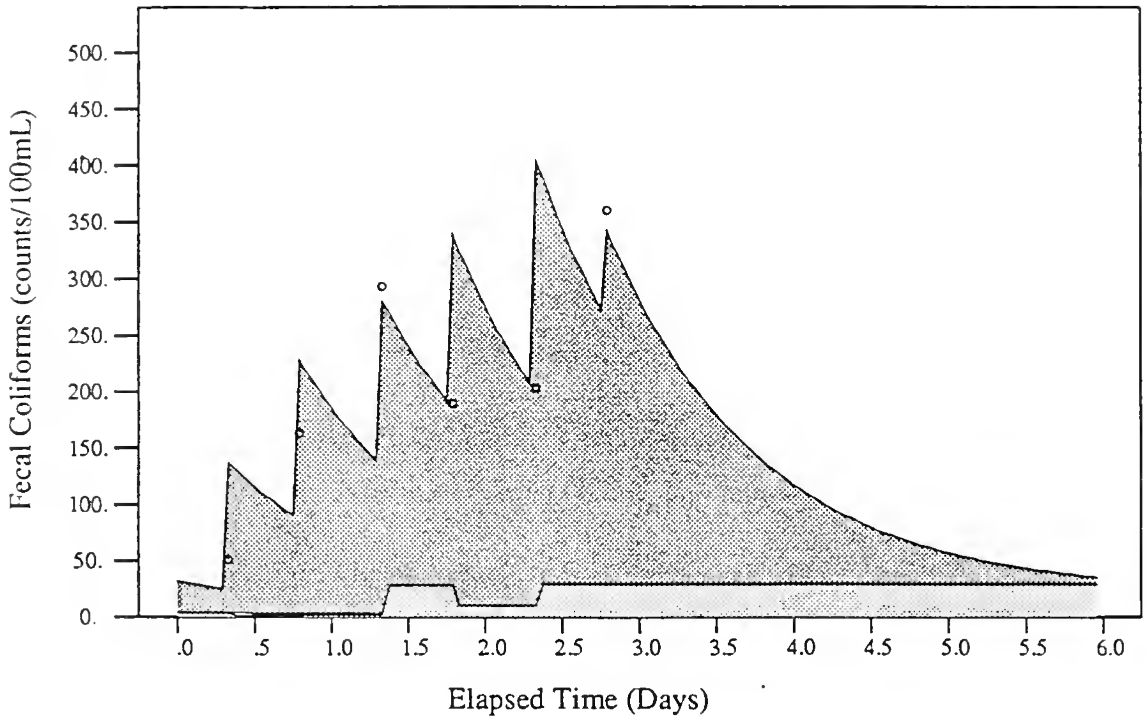
Boat densities observed in Frying Pan Bay and Lost Bay at approximately 08:00 hrs. (AM) and 18:00 hrs. (PM) on the days of sampling are presented as follows:

OBSERVED BOATS

		Frying Pan Bay		Lost Bay	
		Weekend 1	Weekend 2	Weekend 1	Weekend 2
Sat	AM	20	21	12	10
	PM	25	23	22	28
Sun	AM	26	25	24	26
	PM	27	15	24	6
Mon	AM	36	10	24	3
	PM	14	12	12	7

These observed boat densities were combined with the maximum and minimum bacterial loading estimates developed above to give corresponding ranges of daily loading. This analysis is generic as it does not consider variations in the loading which would be expected because of differences in both the types of boats present in the embayments and the variations in number of people per boat as compared to the greywater bacterial characteristics of the boats in the onboard portion of this study. The loadings were assumed to enter the embayment water within a short period of time around the period of sampling. This is a reasonable assumption given that the major volumes of grey water are typically generated during discrete events in the morning and evening.

FIGURE 3-13 FRYING PAN BAY, AUGUST 1-3
FECAL COLIFORMS



FRYING PAN BAY, AUGUST 8-10
FECAL COLIFORMS

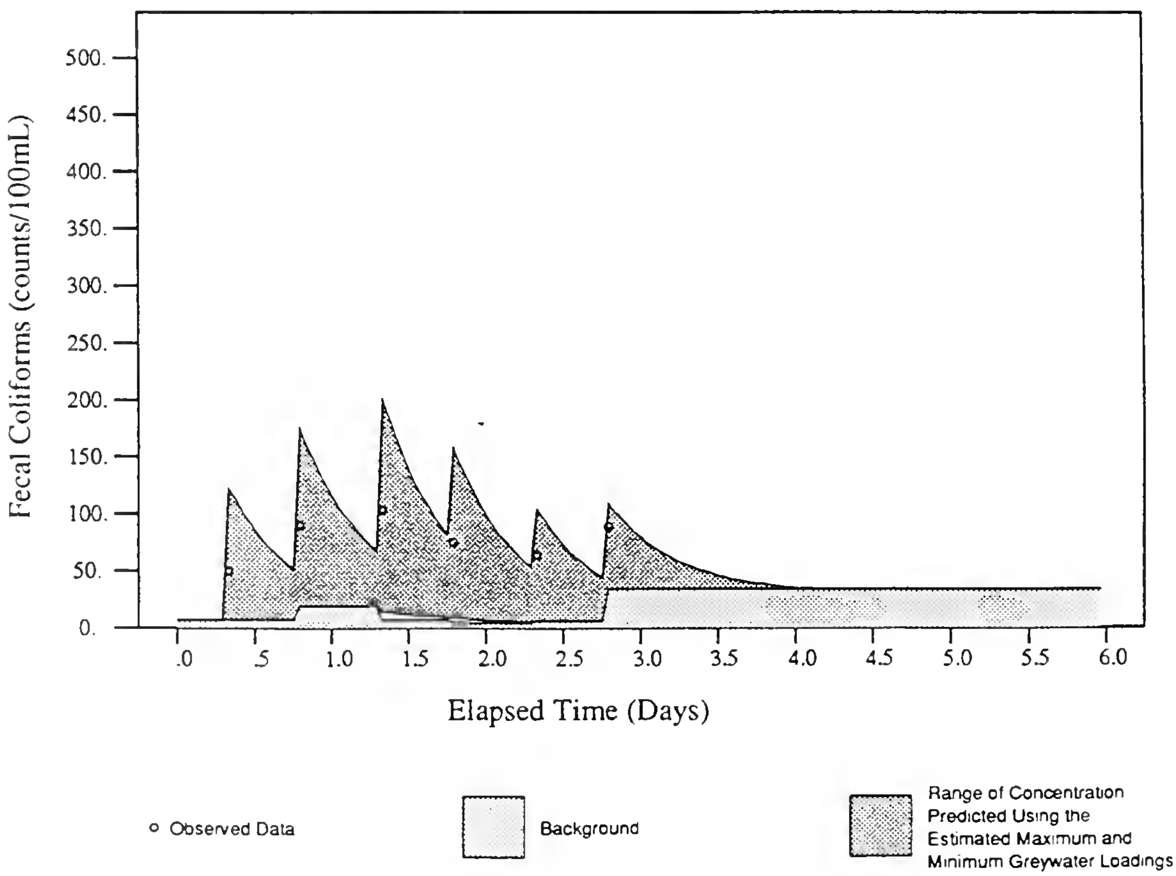
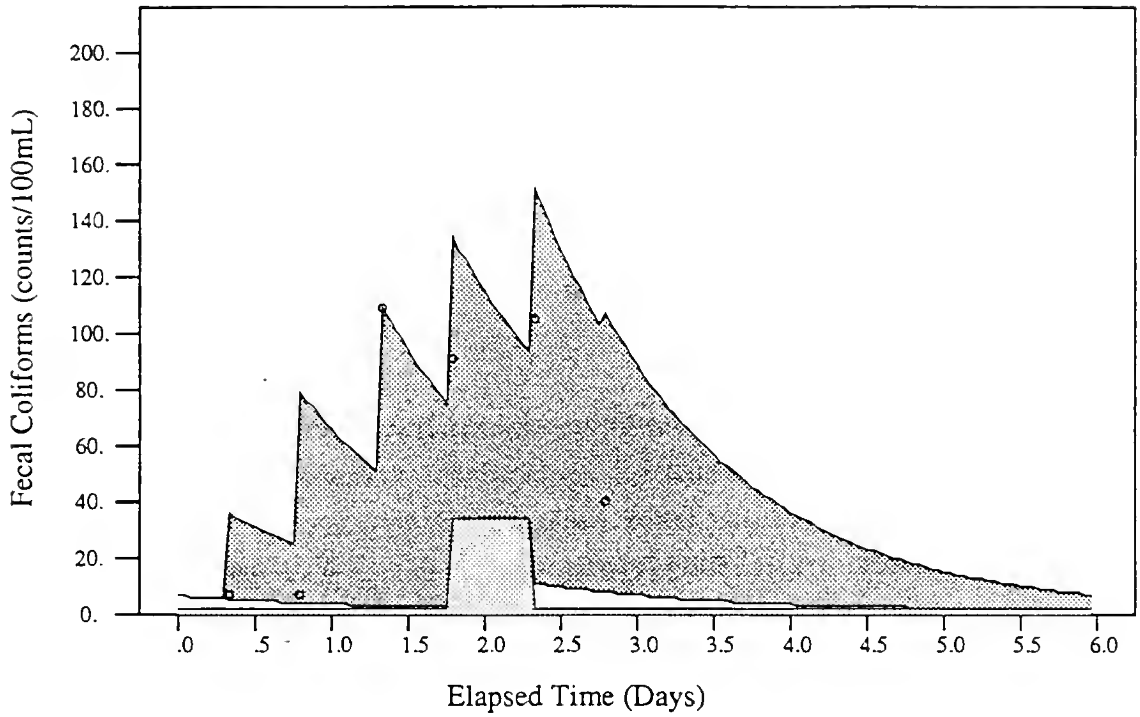
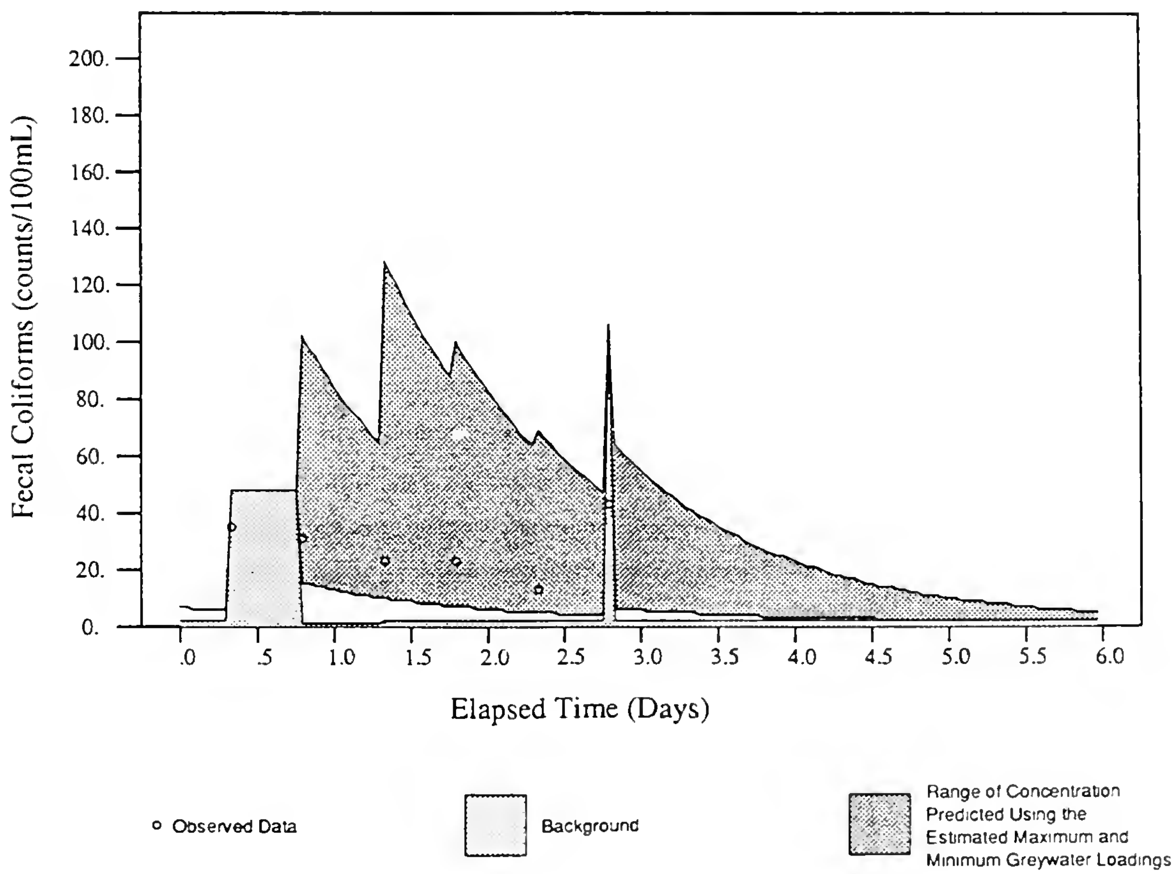


FIGURE 3-14 LOST BAY, AUGUST 1-3
FECAL COLIFORMS



LOST BAY, AUGUST 8-10
FECAL COLIFORMS



Results of this generic modelling are presented in Figure 3.13 for Frying Pan Bay and Figure 3.14 for Lost Bay. In each figure the observed fecal coliform densities are compared to the predicted range of coliform densities resulting from the observed boat densities. The periods of simulation in each case were extended to 6 days. Following the last sample collection on Monday evening all boats were assumed to leave the bays allowing natural exchange and bacterial die-off to reduce the densities towards background levels. This was done to examine the rate of recovery within the embayments.

These modelling results are not intended to suggest that these are the events that occurred on the days of sampling. Rather, they are presented to show the cause and effect relationship of embayment bacterial water quality to boat loadings under the assumptions used in the model. As discussed in section 3.2.1 the day to day variability in both the background and embayment fecal coliform densities prevents any statistically significant conclusions that boats affect embayment water quality. However, the results of the modelling clearly show the interactions between boat bacterial loadings, embayment exchange flow and embayment bacterial water quality. The interaction is barely noticeable using the minimum loading per boat (L min.) and quite noticeable when using the maximum loading per boat (L max.). For the combination of the observed numbers of boats and the value of L min. the total loadings to the embayments are not sufficient to bring the predicted embayment bacterial concentration much above background. Using the combination of the observed numbers of boats and the value of L max. the predicted embayment bacterial concentrations are sufficient to show a dynamic response above background levels. The sharply rising spikes in predicted concentration when using L max. are due to the assumption of pulse loads of bacteria associated with onboard activities each day at 08:00 hrs. and 18:00 hrs. The reduction in predicted concentrations following each spike is due to the combined effects of dilution by exchange flow and bacterial die-off.

The observed fecal coliform data for Frying Pan Bay and Lost Bay generally fall between the range of predicted embayment concentrations resulting from the observed numbers of boats and range of loadings per boat (Lmax, Lmin). In particular, the observed densities in Frying Pan Bay during both surveys and in Lost Bay during the first survey agree remarkably well in terms of trend over the three days of the survey with the predicted values using the assumed maximum loadings per boat per day (Lmax).

Based on this deterministic analysis of the interaction between embayment water quality and boat grey water loadings it is apparent that grey water discharges can adversely affect receiving water quality. The extent of the effect is highly site specific and depends on the number of boats, the volume of the embayment and the extent of the exchange flow between the embayment and surrounding waters. In the present study the effects of grey water discharge were most noticable in Frying Pan Bay during the first sampling on the August 1, 2, 3 holiday weekend because of the relatively small volume of the bay and the high boat useage. Blind channel in Pigeon Lake was not modelled because of the three embayments studied it has the largest volume, least boat density, greatest exchange potential with the surrounding waters, and would be predicted to show little effect. The survey data for Blind Channnel confirms this conclusion.

3.3 Quality Assurance and Quality Control

3.3.1 General

In any field sampling and laboratory analysis project of the type described herein it is important to measure the reliability of the data by a coherent program of internal checks. In this study the quality assurance and quality control (QA/QC) program consisted of a series of triplicate samplings of the grey water and embayment waters to determine the replicability of the sampling process, and a laboratory program of random duplicate analyses, and taxonomic verification to ensure that the laboratory analysis method produced repeatable results and that appropriate organisms were identified.

3.3.2 Triplicate Analysis

Approximately 54 of the grey water samples (24%) and 132 of the embayment samples (33%) were triplicated in the field. The results of the primary samples and the triplicate analyses were compared to identify if any biases existed in the field sampling procedure. The log (10) results for each set of triplicate data were plotted on a graph with the maximum triplicate result as the ordinate and the minimum triplicate as the absissa for each of the three organisms considered in the study (Figure 3.15 to 3.17).

In all three figures it is apparent that there are two distinct groupings of data displayed. The lower of these groups corresponds to the triplicates carried out on the

FIGURE 3-15 HI LO REPLICATE PLOT
FECAL COLIFORMS

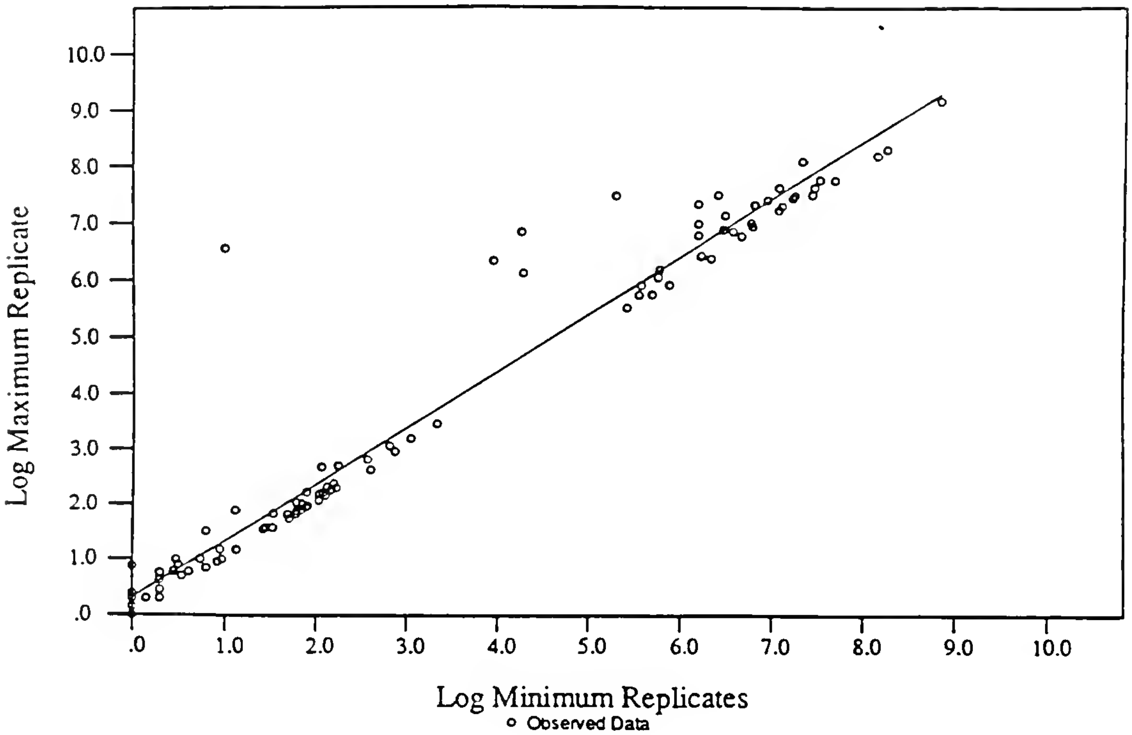


FIGURE 3-16 HI LO REPLICATE PLOT
E. COLI

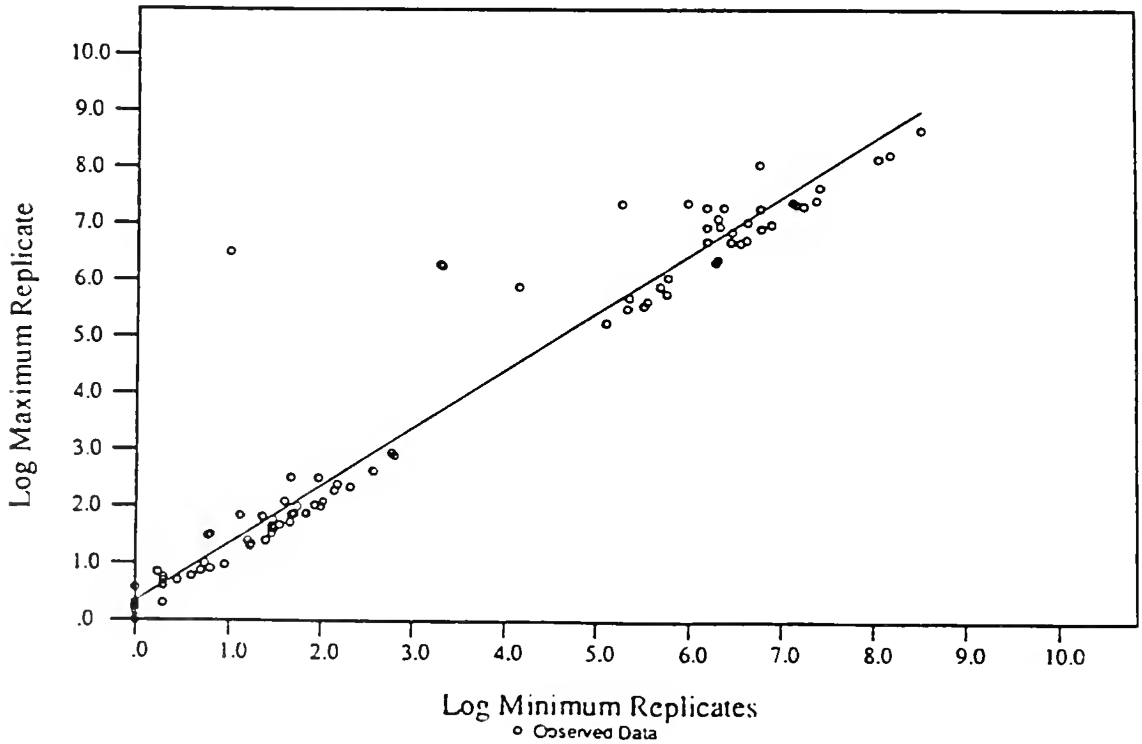


FIGURE 3-17 HI LO REPLICATE PLOT
P. AERUGINOSA

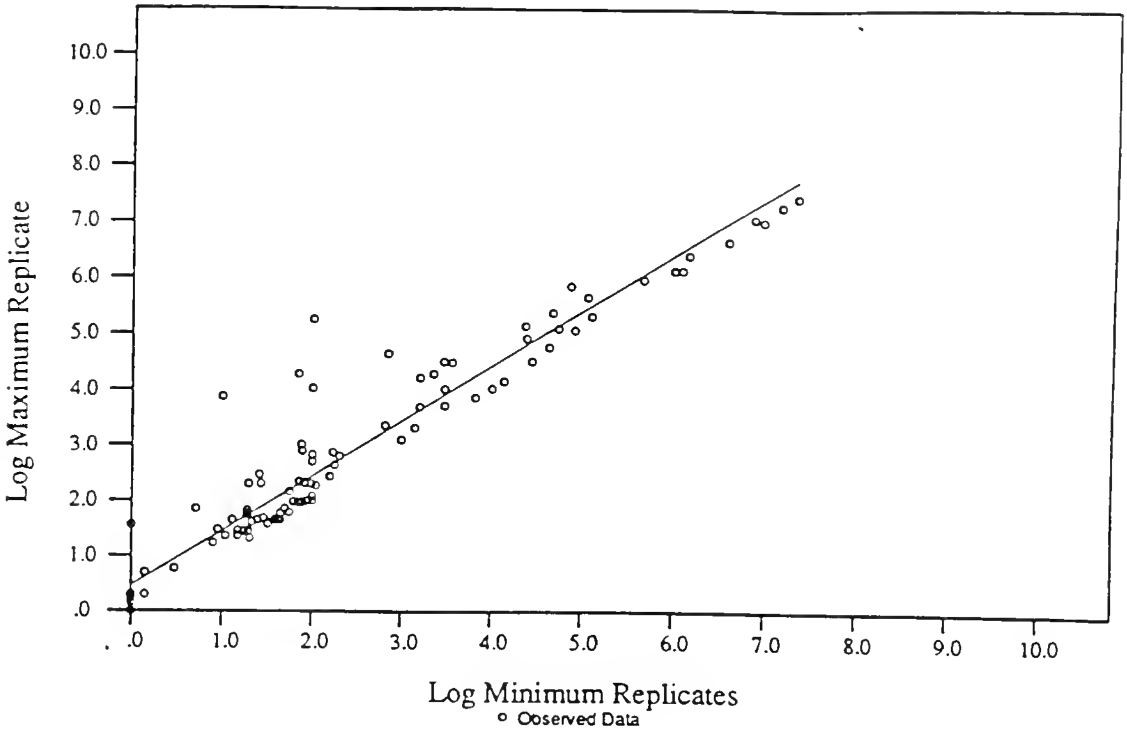


TABLE 3.9: SAMPLING AND ANALYSIS REPLICATE REGRESSION DATA

Sampling Replicate Results

	Slope	Intercept	R^2
Fecal Coliforms	1.01	0.311	0.94
E. coli	1.02	0.331	0.94
P aeruginosa	0.987	0.463	0.92

Analysis Replicate Results

	Slope	Intercept	R^2
Fecal Coliforms	1.00	0.145	0.99
E. coli	1.01	0.113	0.99
P aeruginosa	0.99	0.153	0.98

embayment samples where densities were lower than those observed in the grey water samples. The grey water sample triplicates are represented in the higher group on the two figures. The lines fitted through each of the data sets shows excellent agreement with the data in both the high and low groups indicating consistency in both of the ranges. In the case of P aeruginosa, the demarcation between the grey water samples and the embayment samples is less distinct. However, a good fit has been achieved for the line in this figure as well, indicating good agreement between triplicates.

For the graphs depicted in these figures, a perfect fit of the replicate data would result in a line intercepting the origin and with a slope of 1.0. Departures from this would indicate the presence of a bias in the analytical results. The slopes, intercepts and correlation coefficients for the three organisms are shown in Table 3.9. In each case, the slopes are sufficiently close to unity and the intercepts to zero to conclude there is no sampling bias. This analysis procedure was repeated for the internal laboratory quality control replicates. The results were similar and indicate that there was no analytical bias.

3.4 Taxonomy

3.4.1 General

Several groups of intestinal micro-organisms have been used as indicators of fecal contamination including "fecal streptococci" and "coliform" bacteria. The coliform bacteria are the most commonly used indicator of fecal contamination. Coliforms is an operational and not a taxonomic definition and is defined as those organisms which are gram negative, non-sporeforming rods that ferment lactose to acid and gas at 35°C within 48 hours. This definition includes E. coli, Citrobacter and other related genera such as Klebsiella and Enterobacter. Fecal coliform has the same definition but can ferment lactose to acid and gas at 44.5°C and includes the same organisms. Of these, E. coli is the best indicator of fecal pollution since it is a common inhabitant of the gut and is rarely found outside the gut except if there has been contamination by human or animal excreta. E. coli also dies off in water at a slightly slower rate than typical pathogens (e.g., Salmonella typhi). These attributes of E. coli are in contrast to K. pneumoniae and C. freundii which are found in feces but are also commonly isolated from soils and sediments. E. aerogenes is a normal soil inhabitant.

Pseudomonas aeruginosa is a common soil inhabitant which is also an opportunistic pathogen and can grow at temperatures up to 43°C, whereas other non-pathogenic species of Pseudomonas cannot. It is often associated with swimmers ear, urinary and respiratory tract infections as well as systemic infection in patients that have received severe burns. Further, Pseudomonas aeruginosa, like other Pseudomonas, carry resistance to many antibiotics which makes treatment of infected patients difficult. This examination of waters for Pseudomonas aeruginosa is done for health and safety reasons.

There are many streptococci that exist in the digestive system such as Streptococcus faecalis which is present in the large intestine in significant numbers. Thus this organism can also be used as an indicator of fecal contamination of water. However, its die off rate is slower than E. coli and thus can persist in water after contamination. It is therefore best to use this indicator in conjunction with fecal coliform data to indicate the source and relative time of contamination of water by feces.

Microbiological analyses were carried out by filtering a water sample and then placing the filter on an appropriate selective/differential medium. The individual viable bacterium trapped on the surface of the filter grow into colonies of cells if they can utilize the nutrients provided. After sufficient time the colonies of cells that have arisen from the single cell become visible to the eye. By addition of certain nutrients and inhibitors, only those organisms that can utilize those nutrients and tolerate those inhibitors will grow, thus the media is termed selective. The addition of dye and indicators helps differentiate physiological groups of bacteria. Further, the incubation temperature and atmosphere composition can be used as additional selective mechanisms.

If the bacterium can grow on the medium supplied and under the environment provided it will form distinct colonies which will exhibit specific colony morphology and pigmentation. Similar colonies will theoretically be associated with a bacterial species or physiologically similar groups of organisms. The colonies can then be counted or picked, further purified and then identified by biochemical analyses. If a colony's characteristics match those of a previously identified bacteria's colony formation on that medium, it can be called a typical or positive (+) colony and counted as that organism (Appendix A).

3.4.2 Taxonomic Results

One target group of micro-organisms, the fecal coliforms (FC), and two target micro-organisms, Escherichia coli (EC) and Pseudomonas aeruginosa (PA) were used in this study to gauge the impact of grey water discharge on receiving waters. To determine if the positive fecal coliforms (+FC) were "true" fecal coliforms and that colonies identified as E. coli (+EC) and P. aeruginosa (+PA) were E. coli and P. aeruginosa, respectively, positive colonies were picked from the initial 6 on board samples from each fixture from each boat and identified. The "+" followed by two letters (e.g., EC for E. coli) indicates a colony that matches the typical colony characteristics of that organism, whereas, the "-" indicate a non-typical colony, i.e., it is a colony that does not match the typical colony characteristics of that organism on that media. The organism that was identified is presented under the appropriate heading in Appendix A.

3.4.3 Coliform Identification

Typical (+) fecal coliform colonies are yellow, yellow-brown or yellow-green on m-TEC media. To distinguish E. coli. colonies from other fecal coliforms the filter was transferred from the m-TEC media to a urea broth. If the organism possesses the urease enzyme it liberates ammonia from urea and raises the pH. This change in pH is detected by a pH indicator in the urea broth. E. coli does not possess the urease enzyme and so there will be no colour change around the colony. Other fecal coliforms are typically urease positive, although there are Klebsiella sp. that are urease negative and Citrobacter often has delayed response.

Positive and negative fecal coliform and E. coli colonies were picked and further identified by a Enterobacteriaceae biochemical test strip. Of the 18 positive fecal coliform colonies, only 11 (61%) were identified as fecal coliforms. Of these only 1 was identified as E. coli and the remaining 10 as K. pneumoniae. The remaining 7 isolates were identified as the coliform organism Enterobacter. Fifty isolates were identified as E. coli based on a negative urease response but only 3 (6%) were positively identified using biochemical testing as E. coli. The remaining isolates were identified as Enterobacter sp. (58%), Citrobacter sp. (22%), Klebsiella (8%), and other non-coliforms (6%).

3.4.4 Pseudomonas aeruginosa

Typical positive (+) Pseudomonas aeruginosa populations appear as tan to dark brown colonies on m-PA media after 48 hours at 41.5°C. Positive identification of P. aeruginosa involves transferring the positive colonies to skim milk agar and incubating at 35°C for 24-48 hours. P. aeruginosa will produce a blue-green pigment that diffuses into the surrounding medium and will fluoresce when exposed to UV light. There will be clearing around the colony due to caseinase activity.

The agreement between a typical (+) colony on m-PA and a positive identification as P. aeruginosa on skim milk agar was 100% with 48 of the 48 positive colonies identified as P. aeruginosa. This agreement did not hold for the colonies tested by a commercial biochemical testing strip. Of the three P. aeruginosa type colonies only one was identified as a P. sp. but not as P. aeruginosa. The two negative (non P. aeruginosa like) colonies were not identified as P. aeruginosa. However the test strips used are designed for the Enterobacteriaceae and commonly misidentify Pseudomonads.

3.4.5 Summation of Taxonomic Results

The question arises as to the interpretation of the FC, EC and PA counts as indicators of fecal contamination. Identification of the bacterial isolates show few E. coli, of true fecal origin, versus many Klebsiella pneumoniae, which can be of fecal origin but are also commonly isolated from soils. If the quality of grey water is based solely on fecal coliform counts using the urease test, it could be concluded from the results of this study that these waters were contaminated with fecal matter. However, for those samples subjected to more detailed (selective) analysis, the more specific taxonomic identification of the urease negative fecal coliforms indicate that the majority of fecal coliforms could be derived from other non-fecal sources. It should be noted, however, that P. aeruginosa is an opportunistic pathogen and could pose a health risk regardless of origin.

Although all testing and identification of the colonies was conducted by standard procedures as outlined by the MOE, it is possible that the selection of isolates for identification may be marginally biased. This small bias could be introduced in the sampling of the isolated colonies from the membrane filter, i.e., the selection of colonies

for identification may not have been totally random. Hence, even though the number of isolates taken may be large, the averages given may be slightly skewed.

3.4.6 Fecal Streptococcus Results

The results of the taxonomic analysis described above (Section 3.4.5) raises the significant question of whether or not the contamination of the grey water and subsequently of the embayments themselves is of fecal origin. From the taxonomic analysis it is clear that many of the organisms identified as fecal coliforms by the urease test do not confirm as being of fecal origin. This implies that many of the fecal coliform organisms may originate from non-fecal sources and thereby may not represent a true indication of the possibility of pathogenic organisms. To further study the possible presence of pathogenic organisms, the Fecal streptococcus results from the first three grey water samples from each boat and fixture were considered.

The MOE Blue Book ("Water Management, Policies Goals and Objectives of the Ministry of the Environment", May 1978) describes a rule of thumb whereby some indication of the origin of fecal pollution may be gained. If the ratio of fecal coliform to fecal streptococcus is greater than 4.0, it is considered an indication of pollution of human origin. If the ratio is less than 0.7, human origin cannot be assumed. Between these two rather wide values no conclusion can be drawn. However, more recent work by MOE has shown the use of this method is cautionary since the data are highly variable by nature and the relative ages of the samples can affect the relationship due to unequal die-off rates for the two organisms. Further, the number of Fecal streptococcus analyses is limited making extrapolation to the total of the grey water samples tenuous at best.

The results of the fecal coliform to fecal strep ratio should be viewed with further caution since it presumes that the fecal coliform are confirmed <u>E. coli</u> (i.e., of fecal origin). From the confirmatory test results reported previously, some doubt exists as to the robustness of the conclusion that the fecal coliform and <u>E. coli</u> densities observed are demonstrably fecal in origin. If a large proportion of the bacteria measured as fecal coliform and <u>E. coli</u> are not positively identified as such, then the results of the ratio analysis are invalid. The results nevertheless are offered for consideration.

TABLE 3.10: FECAL STREPTOCOCCUS TO FECAL COLIFORM COMPARISON

Sample Location	Fecal Coliforms (per 100 ml)	Log FC	Fecal Strep. (per 100 ml)	Log FS	Fecal Strep./ Fecal Coli
Headsink Data	6.1×10^4	4.79	5.0×10^2	2.70	122.0
	1.8×10^4	4.26	2.3×10^4	3.36	7.9
	2.0×10^6	6.30	1.6×10^5	4.20	125.0
	3.8×10^5	5.58	1.3×10^5	5.11	2.9
	1.0×10^4	4.00	3.0×10^4	4.48	0.3
	1.2×10^7	7.08	1.2×10^6	6.09	9.8
	3.8×10^6	6.58	1.0×10^2	2.00	38,000.0
	1.0×10^5	5.00	9.5×10^2	2.98	105.3
	1.1×10^4	4.04	4.2×10^3	3.62	2.6
Geometric Mean	2.0×10^5		6.9×10^3	28.4	
Shower Data	4.0×10^5	5.60	7.3×10^4	4.86	5.5
	9.0×10^3	3.95	4.4×10^4	4.64	0.2
	4.8×10^7	7.68	2.0×10^6	5.30	240.0
	2.2×10^6	6.34	2.1×10^6	6.32	1.0
	2.7×10^7	7.43	8.6×10^4	4.93	314.0
	1.1×10^5	5.04	1.1×10^4	4.06	9.6
	3.4×10^5	5.53	2.5×10^4	4.40	13.6
	1.6×10^5	5.20	1.2×10^4	4.08	13.1
	1.4×10^6	6.15	2.9×10^6	6.46	0.5
Geometric Mean	7.6×10^5		1.0×10^5	7.5	
Galley Sink Data	1.5×10^7	7.18	1.0×10^2	2.00	150,000.0
	4.0×10^3	3.60	1.0×10^1	1.00	400.0
	2.1×10^7	7.32	1.0×10^3	3.00	21,000.0
	5.0×10^6	6.70	6.6×10^5	5.82	7.6
	1.6×10^5	5.20	1.8×10^5	5.25	0.9
	6.0×10^6	6.78	4.3×10^5	5.63	14.0
	1.0×10^1	1.00	5.0×10^1	1.70	0.2
	1.0×10^1	1.00	2.1×10^3	3.32	0.0
	1.8×10^7	7.25	1.0×10^3	3.00	18,000.0
Geometric Mean	1.3×10^5		2.6×10^3	50.2	

The ratios were calculated for each sample and for the geometric means of the two strains for each of the fixtures. No attempt was made to differentiate between boats (Table 3.10). All three of the fixture geometric means were also greater than 4.0.

3.5 Marina Pumpout Capacity Survey

An important part of this project was to determine the effect of any possible regulatory action regarding grey water holding upon the available pumpout facilities in the province. To fulfill this component of the project, a survey of the yacht clubs, marinas and community facilities in the major boating areas of the province was carried out. In Lake Ontario, Rideau River, Trent System, and Southern Georgian Bay, the majority of selected sites were visited in person. In the Lake of the Woods area a telephone survey was conducted. A total of 98 sites were contacted during the survey and a questionnaire completed on each site (Appendix B).

Pumpout locations were found to vary widely in their hours of operation and to some degree in their open season. In general they are open for 4 to 12 hours daily from May to October. Typically, each location has one pumpout hose available which discharges to a holding tank, directly to sewer or to a tile field. In the case of those locations discharging to a holding tank, periodic pumpouts of the holding tank are required. These typically vary from 1 to 8 per month. The number of boats serviced varied from 5 to 160 per week. In areas where large numbers of boats were serviced, multiple pumpout hoses were typically available.

The principal purpose of carrying out the pumpout survey was to determine the available capacity. The capacity of a single pumpout facility is a function of the pump capacity, the hours of operation, the size of the holding tank if applicable, the productivity of the attendants and the time required to manouver boats into and out of the facility. In addition, many pumpouts are situated adjacent to fueling facilities, and pumpout activity is usually carried out at the same time as refueling which increases the time each boat is tied to the dock.

The size of the holding tank to which the waste pump discharges is a restriction on the overall capacity of the facility only if it can be filled with a normal day's operation. In this case, the facility would be out of service regularly. This is not the case for most of

the facilities surveyed. Therefore, holding tank capacity is not a strong restriction since capacity is restored each time the haulage truck arrives and evacuates the tank. Additional pumpout demand would precipitate more haulage events. For those facilities which discharge directly to sewerage systems, there is effectively no limitation upon the volume of pumpout fluids which can be accommodated. Approximately 12% of the pumpout facilities contacted reported that they discharge to tile fields, but many also reported that waste was hauled. The capacity of a tile field is a true limitation on the volume of pumpout fluids which can be accommodated.

Based upon the above discussion, the capacity of the existing pumpout facilities in the province is more a function of the number of boats that can be serviced than the volume of wastes generated. Accordingly, the number of boats which can be accommodated at a given facility with one hose is estimated to be four per hour. Because of the demands upon attendants' time for refueling and other marina duties, a total of 6 hours per day of pumpout activity was assumed. These assumptions lead to an estimate of the available capacity in terms of boats. The number of boats currently being serviced represents the portion of total capacity in use. The difference represents the un-used capacity of the facilities. Using these assumptions, the available capacity in each of the regions was calculated for those facilities which were open to the public.

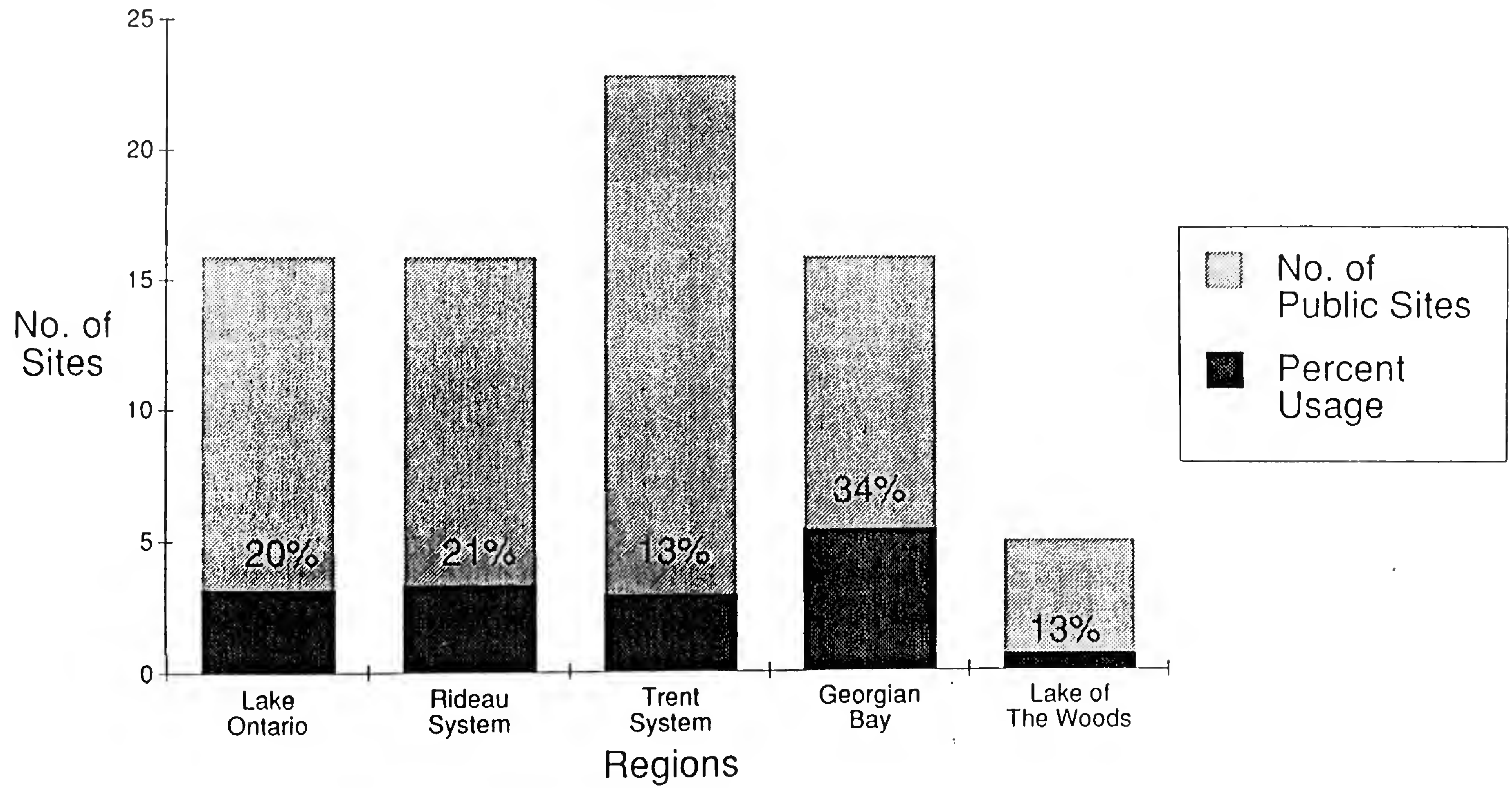
The results of the capacity calculations show that a large amount of the installed capacity is not utilized (Figure 3.18). Overall usage of pumpout facilities varied from 13% in the Lake of the Woods area to 34% in the southern Georgian Bay area. From this analysis it appears that significant additional capacity is available for grey water pumping.

However, based on the measured and estimated rates of grey and black water production and assuming that grey water is contained in onboard tankage sized to provide the same number of days retention as the black water tank, then the pumpout utilization would increase by 250 to 300 percent over present levels. This would increse the existing utilization to 100 percent in the southern Georgian Bay area.

It should be noted that by design the study focussed on those areas in the province with the greatest pleasure boat densities and hence areas with the best coverage of pumpout facilities. Other areas frequented by pleasure boats are known to be poorly serviced or

virtually unserviced (e.g., Northeast Shore of Georgian Bay, North Channel of Lake Huron and North Shore of Lake Superior). Restrictions on Grey Water discharge would severely limit recreational boating in such areas unless a suitable network of pumpout facilities were provided.

FIGURE 3.18
PUMPOUT STATIONS AVAILABLE TO THE PUBLIC



4.0 SUMMARY

1. The data collected on the bacterial densities in the grey water samples from the pleasure boats and in the embayment samples was subjected to a quality control and quality assurance procedure which indicated that the results were not subject to any sampling or analytical bias. Accordingly, these results may be used in evaluating the bacterial quality of the grey water and the effects of the discharge of the grey water upon the embayment receiving waters chosen for study.

2. The Ministry of the Environment "Blue Book" containing objectives for recreational water use states that a potential health hazard exists:

   - "if the fecal coliform geometric mean density for a series of samples exceeds 100 per 100 ml";
   - "when pathogenic organisms (e.g., Pseudomonas aeruginosa ...) can be enumerated and frequently isolated from the water".

3. Based on the results of MOE standard presumptive test procedures, the grey water produced by the use of the galley sink, head sink and the shower exhibits high densities of fecal coliforms, E. coli and Pseudomonas aeruginosa. Densities were found to be in the range of 10^4 to 10^8 organisms/100 ml for fecal coliform and E. coli, and from 10^2 to 10^6 organisms/100 ml for Pseudomonas aeruginosa.

4. However, when a subset of the bacteria identified as E. coli using standard presumptive test procedures were subjected to confirmatory taxonomic analyses, only 6 percent of the subset so evaluated were confirmed as the species E. coli. Assuming the results of the confirmatory analyses are representative over the entire set of presumptive tests, only a small percentage of the fecal coliform containing samples identified using routine presumptive test procedures was actually of fecal origin. On the other hand, confirmatory taxonomic analyses on a similar subset of bacteria identified as positive using standard presumptive tests for Pseudomonas aeruginosa resulted in 100 percent confirmation of this species. Again, assuming the results of the confirmatory analyses are representative over the entire set of presumptive tests implies that the P. aeruginosa are actually present.

5. No single fixture could be identified as being consistently higher in bacterial density than any of the others. However, on many occasions, the galley sink densities were the highest. Similarly, no single type of boat was observed to exhibit higher densities than either of the other boat types studied. Crew lifestyle was found to be a significant factor in the overall variability of grey water quality.

6. An analysis of conventional pollutants (nutrients, solids, and oxygen demanding substances) revealed that grey water from all three fixtures exhibited high concentrations. However, because of relatively small volumes, the mass loadings of these substances were small.

7. The onboard fresh water use data suggest a range of consumption dependent on lifestyle and available potable water tankage. Water use was 16.6 and 21.7 litres per capita per day (l/c/d) for the sail and power boats, respectively. The observed water use in the house boat was 5.9 l/c/d. However, this latter value was thought to be significantly low, a more reasonable estimate being in the order of 21 l/c/d. Black water production was estimated to average 10 l/c/d.

8. Based on results of presumptive testing, fecal coliform concentrations in two of the studied embayments, Frying Pan Bay and Lost Bay, were observed to rise to levels in excess of the MOE Blue Book objectives for the recreational use of water during the summer weekends studied. Significant levels of P. aeruginosa were observed for all three embayments.

9. No statistically significant simple relationship between the number of boats in an embayment and the bacterial density of any of the three bacterial species (FC, EC, PA) could be found in the data collected in this survey. However, a deterministic model, simulating the inputs, exchange and natural die-off kinetics of fecal coliforms indicated that the observed fecal coliform densities in the embayments were consistent with those expected, given the range of grey water bacterial loadings possible from the boats present at the time of sampling.

10. The effects of grey water upon the bacterial quality of embayment waters is highly site specific. In small, heavily used bays, effects can be observed. In larger, less used or better flushed locations, effects cannot be observed.

11. There is presently excess pumpout capacity along the major recreational waterways of the province. Other waterways and recreational boating areas are poorly serviced (e.g., north east shore of Georgian Bay, Lake Huron North Channel, and north shore of Lake Superior). Grey water retention would increase the volume of pumpouts by 250 to 300 percent. This would bring existing pumpout utilization to nearly 100 percent of capacity in the Southern Georgian Bay area, which presently has the highest utilization of the areas surveyed.

5.0 CONCLUSIONS

1. Data from the study indicate that few of the fecal coliforms and *E. coli* measured in the grey water are likely to actually be of fecal origin.

2. *Pseudomonas aeruginosa* was found in the grey water at both the presumptive and taxonomic levels of analysis, and was also found using presumptive test procedures in the receiving waters, both in the test embayments and control sites. It is a known opportunistic pathogen which is described in the MOE "Blue Book" as a potential health hazard if found in recreational waters.

3. Grey water from all three fixtures exhibited high concentrations of conventional pollutants (nutrients, solids, and oxygen-demanding substances). However, because of the relatively small volumes, the mass loadings of these substances was small.

4. Presumptive analysis of the grey water showed that the fecal coliform count exceeded, by several orders of magnitude, the MOE "Blue Book" objective for recreational water use of 100 fecal coliforms per 100 mL of water. Yet, as noted above, taxonomic analysis indicated that only a small percentage of the fecal coliforms in grey water was actually of fecal origin. However, because of the high concentrations reported, this would still indicate the potential for some fecal contamination of the receiving waters. These results would also indicate that the existing MOE fecal coliform standard may not be appropriate.

5. If it should be decided to require that pleasure boats retain grey water on board, it seems likely that, along the major recreational waterways, there would at present be adequate pump-out facilities to receive it. However, in areas with few pump-out facilities (e.g. north-east Georgian Bay, North Channel and Lake Superior), it would be necessary for new pump-out facilities to be established.

APPENDIX A

BACTERIAL ANALYSIS DATA
TAXONOMY DATA

BACTERIAL ANALYSIS DATA

1987
Report of Bacterial Analysis

NOTE: (-2) means less then 2/100mls
(1999) means greater then 1999/100mls
Calculations are based only on 11 stations for embayment sampling

Lab No.	Sample Station		DATE Rec'd mmddyy		Fecal Coliforms per 100mls	log-10		E. coli per 100mls	LOG-10		Pseudomonas aeruginosa per 100mls	LOG-10
7098	BC-1-2	BC-1- 2	080287		24	1.3802		11	1.0414	<	1	0.0000
7099	BC-1-3	BC-1- 3	080287		1	0.0000		1	0.0000	<	1	0.0000
7100	BC-1-4	BC-1- 4	080287	<	1	0.0000	<	1	0.0000	<	1	0.0000
7101	BC-1-5	BC-1- 5	080287	<	1	0.0000	<	1	0.0000	<	1	0.0000
7102	BC-1-6	BC-1- 6	080287		15	1.1761		2	0.3010	<	1	0.0000
7103	BC-1-7	BC-1- 7	080287		2	0.3010		1	0.0000	<	1	0.0000
7104	BC-1-8	BC-1- 8	080287		3	0.4771		2	0.3010	<	1	0.0000
7105	BC-1-9	BC-1- 9	080287		30	1.4771		20	1.3010	<	1	0.0000
7106	BC-1-11	BC-1- 11	080287		2	0.3010		2	0.3010	<	1	0.0000
				MEAN		0.6014	MEAN		0.3681	MEAN		0.0000
				VARIANCE		0.3618	VARIANCE		0.2343	VARIANCE		0.0000
7107	BC-2-1	BC-2- 1	080287		69	1.8388		2	0.3010	<	1	0.0000
7116	BC-2-10	BC-2- 10	080287	<	1	0.0000	<	1	0.0000	<	1	0.0000
7108	BC-2-2	BC-2- 2	080287		4	0.6021		3	0.4771		4	0.6021
7109	BC-2-3	BC-2- 3	080287		1	0.0000		1	0.0000	<	1	0.0000
7110	BC-2-4	BC-2- 4	080287		7	0.8451		2	0.3010	<	1	0.0000
7111	BC-2-5	BC-2- 5	080287		3	0.4771	<	1	0.0000	<	1	0.0000
7112	BC-2-6	BC-2- 6	080287		110	2.0414		110	2.0414		1	0.0000
7113	BC-2-7	BC-2- 7	080287		5	0.6990		2	0.3010	<	1	0.0000
7114	BC-2-8	BC-2- 8	080287		47	1.6721		27	1.4314	<	1	0.0000
7115	BC-2-9	BC-2- 9	080287		1	0.0000		1	0.0000	<	1	0.0000
7117	BC-2-11	BC-2- 11	080287		80	1.9031	<	1	0.0000	<	1	0.0000
				MEAN		0.9162	MEAN		0.4412	MEAN		0.0547
				VARIANCE		0.5932	VARIANCE		0.4159	VARIANCE		0.0300
7118	BC-3-1	BC-3- 1	080287	<	1	0.0000	<	1	0.0000	<	1	0.0000
7127	BC-3-10	BC-3- 10	080287	<	1	0.0000	<	1	0.0000	<	1	0.0000
7119	BC-3-2	BC-3- 2	080287		40	1.6021		1	0.0000	<	1	0.0000
7120	BC-3-3	BC-3- 3	080287		2	0.3010	<	1	0.0000		1	0.0000
7121	BC-3-4	BC-3- 4	080287		2	0.3010	<	1	0.0000	<	1	0.0000
7122	BC-3-5	BC-3- 5	080287	<	1	0.0000	<	1	0.0000	<	1	0.0000

[illegible]	[illegible]	[illegible]	[illegible]			0.0000	1	0.0000 <	1	0.0000
7124	BC-3-7	BC-3- 7	080287		1	0.0000 <	1	0.0000 <	1	0.0000
7125	BC-3-8	BC-3- 8	080287		190	2.2788	2	0.3010 <	1	0.0000
7126	BC-3-9	BC-3- 9	080287		37	1.5682	2	0.3010 <	1	0.0000
7128	BC-3-11	BC-3- 11	080287		1	0.0000	1	0.0000 <	1	0.0000
				MEAN		0.5501	MEAN	0.0547	MEAN	0.0000
				VARIANCE		0.6428	VARIANCE	0.0135	VARIANCE	0.0000
7267	BC-4-1	BC-4- 1	080387		2	0.3010	2	0.3010	1	0.0000
7275	BC-4-10	BC-4- 10	080387		5	0.6990	5	0.6990	-2	0.3010
7268	BC-4-2	BC-4- 2	080387		32	1.5051	32	1.5051 <	1	0.0000
7302	BC-4-30C	BC-4- 30C	080387		4	0.6021	2	0.3010 <	1	0.0000
7269	BC-4-4	BC-4- 4	080387		1	0.0000	1	0.0000 <	1	0.0000
7270	BC-4-5	BC-4- 5	080387		-2	0.3010	-2	0.3010 <	1	0.0000
7271	BC-4-6	BC-4- 6	080387		2	0.3010 <	1	0.0000 <	1	0.0000
7272	BC-4-7	BC-4- 7	080387		-2	0.3010	-2	0.3010 <	1	0.0000
7273	BC-4-8	BC-4- 8	080387		6	0.7782	2	0.3010 <	1	0.0000
7274	BC-4-9	BC-4- 9	080387		2	0.3010	-2	0.3010 <	1	0.0000
7276	BC-4-11	BC-4- 11	080387		76	1.8808	70	1.8451 <	1	0.0000
7309	BC-4-100C	BC-4- 100C	080387		-2	0.3010	-2	0.3010	-2	0.3010
7298	BC-4-100C	BC-4- 100C	080387		6	0.7782	4	0.6021 <	1	0.0000
7311	BC-4-100CR	BC-4- 100CR	080387		-2	0.3010	-2	0.3010	-2	0.3010
7299	BC-4-110C	BC-4- 110C	080387		88	1.9445	88	1.9445 <	1	0.0000
7310	BC-4-110C	BC-4- 110C	080387		2	0.3010	-2	0.3010	-2	0.3010
7312	BC-4-110CR	BC-4- 110CR	080387		-2	0.3010	-2	0.3010	-2	0.3010
7300	BC-4-10C	BC-4- 10C	080387		4	0.6021	2	0.3010 <	1	0.0000
7289	BC-4-10C	BC-4- 10C	080387		2	0.3010	-2	0.3010 <	1	0.0000
7301	BC-4-20C	BC-4- 20C	080387		20	1.3010	20	1.3010 <	1	0.0000
7290	BC-4-20C	BC-4- 20C	080387		-2	0.3010	-2	0.3010 <	1	0.0000
7291	BC-4-30C	BC-4- 30C	080387		8	0.9031	-2	0.3010 <	1	0.0000
7292	BC-4-40C	BC-4- 40C	080387		8	0.9031	-2	0.3010 <	1	0.0000
7303	BC-4-40C	BC-4- 40C	080387		7	0.8451	7	0.8451	-2	0.3010
7293	BC-4-50C	BC-4- 50C	080387		-2	0.3010	-2	0.3010 <	1	0.0000
7304	BC-4-50C	BC-4- 50C	080387		2	0.3010	2	0.3010 <	1	0.0000
7294	BC-4-60C	BC-4- 60C	080387		-2	0.3010	-2	0.3010 <	1	0.0000
7305	BC-4-60C	BC-4- 60C	080387		2	0.3010	-2	0.3010 <	1	0.0000
7306	BC-4-70C	BC-4- 70C	080387.		16	1.2041	12	1.0792	1	0.0000
7295	BC-4-70C	BC-4- 70C	080387		-2	0.3010	-2	0.3010 <	1	0.0000
7307	BC-4-80C	BC-4- 80C	080387	<	1	0.0000 <	1	0.0000 <	1	0.0000
7296	BC-4-80C	BC-4- 80C	080387		17	1.2304	17	1.2304	-2	0.3010
7297	BC-4-90C	BC-4- 90C	080387		2	0.3010	2	0.3010 <	1	0.0000
7308	BC-4-90C	BC-4- 90C	080387		4	0.6021	2	0.3010 <	1	0.0000
				MEAN		0.6337	MEAN	0.5323	MEAN	0.0274
				VARIANCE		0.2996	VARIANCE	0.3259	VARIANCE	0.0075
7277	BC-5-1	BC-5- 1	080387		10	1.0000	10	1.0000 <	1	0.0000

7286 BC-5-10	BC-5- 10	080387		2	0.3010	-2	0.3010 <		1	0.0000
7278 BC-5-2	BC-5- 2	080387		2	0.3010	2	0.3010 <		1	0.0000
7279 BC-5-3	BC-5- 3	080387		-2	0.3010	-2	0.3010		1	0.0000
7280 BC-5-4	BC-5- 4	080387		2	0.3010	2	0.3010		1	0.0000
7281 BC-5-5	BC-5- 5	080387		-2	0.3010	-2	0.3010 <		1	0.0000
7282 BC-5-6	BC-5- 6	080387		-2	0.3010	-2	0.3010 <		1	0.0000
7283 BC-5-7	BC-5- 7	080387		10	1.0000 <	1	0.0000 <		1	0.0000
7284 BC-5-8	BC-5- 8	080387		2	0.3010	2	0.3010 <		1	0.0000
7285 BC-5-9	BC-5- 9	080387		2	0.3010	2	0.3010 <		1	0.0000
7287 BC-5-11	BC-5- 11	080387		2	0.3010	2	0.3010 <		1	0.0000
7288 BC-5-12	BC-5- 12	080387		2	0.3010	2	0.3010 <		1	0.0000
			MEAN		0.4281	MEAN	0.3372	MEAN		0.0000
			VARIANCE		0.0727	VARIANCE	0.0513	VARIANCE		0.0000
7385 BC-6-1	BC-6- 1	080487		2	0.3010	2	0.3010 <		1	0.0000
7394 BC-6-10	BC-6- 10	080487		8	0.9031	7	0.8451 <		1	0.0000
7386 BC-6-2	BC-6- 2	080487		8	0.9031	8	0.9031 <		1	0.0000
7387 BC-6-3	BC-6- 3	080487		2	0.3010 <	1	0.0000		1	0.0000
7388 BC-6-4	BC-6- 4	080487		3	0.4771	3	0.4771 <		1	0.0000
7389 BC-6-5	BC-6- 5	080487		4	0.6021	3	0.4771 <		1	0.0000
7390 BC-6-6	BC-6- 6	080487		9	0.9542	5	0.6990		1	0.0000
7391 BC-6-7	BC-6- 7	080487		14	1.1461	3	0.4771 <		1	0.0000
7392 BC-6-8	BC-6- 8	080487		26	1.4150	16	1.2041		1	0.0000
7393 BC-6-9	BC-6- 9	080487		6	0.7782	5	0.6990		6	0.7782
7395 BC-6-11	BC-6- 11	080487		36	1.5563	26	1.4150 <		1	0.0000
7396 BC-6-12	BC-6- 12	080487		13	1.1139	13	1.1139 <		1	0.0000
			MEAN		0.8488	MEAN	0.6816	MEAN		0.0707
			VARIANCE		0.1573	VARIANCE	0.1475	VARIANCE		0.0500
7505 BC-7-1	BC-7- 1	080887	<	1	0.0000 <	1	0.0000 <		1	0.0000
7514 BC-7-10	BC-7- 10	080887		1	0.0000	1	0.0000 <		1	0.0000
7506 BC-7-2	BC-7- 2	080887	<	1	0.0000 <	1	0.0000 <		1	0.0000
7507 BC-7-3	BC-7- 3	080887		3	0.4771	3	0.4771 <		1	0.0000
7508 BC-7-4	BC-7- 4	080887		1	0.0000 <	1	0.0000 <		1	0.0000
7509 BC-7-5	BC-7- 5	080887	<	1	0.0000 <	1	0.0000 <		1	0.0000
7510 BC-7-6	BC-7- 6	080887	<	1	0.0000 <	1	0.0000 <		1	0.0000
7511 BC-7-7	BC-7- 7	080887		1	0.0000	1	0.0000 <		1	0.0000
7512 BC-7-8	BC-7- 8	080887	<	1	0.0000 <	1	0.0000 <		1	0.0000
7513 BC-7-9	BC-7- 9	080887	<	1	0.0000 <	1	0.0000 <		1	0.0000
7515 BC-7-11	BC-7- 11	080887		-2	0.3010	-2	0.3010 <		1	0.0000
7516 BC-7-11R	BC-7- 11R	080887		-10	1.0000	-10	1.0000		-5	0.6990
			MEAN		0.0707	MEAN	0.0707	MEAN		0.0000
			VARIANCE		0.0239	VARIANCE	0.0239	VARIANCE		0.0000

7533	BC-8-1	BC-8- 1	080987		25	1.3979	5	0.6990	1	0.0000
7542	BC-8-10	BC-8- 10	080987		2	0.3010	2	0.3010 <	1	0.0000
7534	BC-8-2	BC-8- 2	080987		3	0.4771	3	0.4771 <	1	0.0000
7535	BC-8-3	BC-8- 3	080987		2	0.3010	2	0.3010 <	1	0.0000
7536	BC-8-4	BC-8- 4	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7537	BC-8-5	BC-8- 5	080987	<	1	0.0000 <	1	0.0000	1	0.0000
7538	BC-8-6	BC-8- 6	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7539	BC-8-7	BC-8- 7	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7540	BC-8-8	BC-8- 8	080987		1	0.0000	1	0.0000 <	1	0.0000
7541	BC-8-9	BC-8- 9	080987		3	0.4771	3	0.4771 <	1	0.0000
7543	BC-8-11	BC-8- 11	080987		1	0.0000	1	0.0000 <	1	0.0000
				MEAN		0.2686	MEAN	0.2050	MEAN	0.0000
				VARIANCE		0.1634	VARIANCE	0.0602	VARIANCE	0.0000
7544	BC-9-1	BC-9- 1	080987		15	1.1761	8	0.9031	8	0.9031
7571	BC-9-10	BC-9- 10	080987	<	1	0.0000 <	1	0.0000	5	0.6990
7547	BC-9-2	BC-9- 2	080987		2	0.3010	2	0.3010 <	1	0.0000
7550	BC-9-3	BC-9- 3	080987		10	1.0000	10	1.0000 <	1	0.0000
7553	BC-9-4	BC-9- 4	080987		1	0.0000	1	0.0000 <	1	0.0000
7556	BC-9-5	BC-9- 5	080987		2	0.3010	2	0.3010 <	1	0.0000
7559	BC-9-6	BC-9- 6	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7562	BC-9-7	BC-9- 7	080987		2	0.3010	1	0.0000	2	0.3010
7565	BC-9-8	BC-9- 8	080987		1	0.0000 <	1	0.0000 <	1	0.0000
7568	BC-9-9	BC-9- 9	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7574	BC-9-11	BC-9- 11	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7572	BC-9-100C	BC-9- 100C	080987	<	1	0.0000 <	1	0.0000	2	0.3010
7573	BC-9-100C	BC-9- 100C	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7575	BC-9-110C	BC-9- 110C	080987		-2	0.3010	-2	0.3010	30	1.4771
7576	BC-9-110C	BC-9- 110C	080987		-2	0.3010	-2	0.3010	44	1.6435
7577	BC-9-110CR	BC-9- 110CR	080987		-2	0.3010	-2	0.3010	30	1.4771
7578	BC-9-110CR	BC-9- 110CR	080987		-2	0.3010	-2	0.3010	58	1.7634
7545	BC-9-10C	BC-9- 10C	080987		10	1.0000	5	0.6990	14	1.1461
7546	BC-9-10C	BC-9- 10C	080987		8	0.9031	8	0.9031	21	1.3222
7548	BC-9-20C	BC-9- 20C	080987		1	0.0000	1	0.0000	1	0.0000
7549	BC-9-20C	BC-9- 20C	080987		1	0.0000	1	0.0000	1	0.0000
7552	BC-9-30C	BC-9- 30C	080987		5	0.6990	5	0.6990	1	0.0000
7551	BC-9-30C	BC-9- 30C	080987		6	0.7782	6	0.7782	4	0.6021
7555	BC-9-40C	BC-9- 40C	080987		3	0.4771	3	0.4771 <	1	0.0000
7554	BC-9-40C	BC-9- 40C	080987		2	0.3010	1	0.0000	1	0.0000
7558	9C-9-50C	BC-9- 50C	080987		3	0.4771	3	0.4771 <	1	0.0000
7557	BC-9-50C	BC-9- 50C	080987		6	0.7782	6	0.7782 <	1	0.0000
7561	BC-9-60C	BC-9- 60C	080987		2	0.3010	1	0.0000 <	1	0.0000
7560	BC-9-60C	BC-9- 60C	080987	<	1	0.0000 <	1	0.0000	1	0.0000
7563	BC-9-70C	BC-9- 70C	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7564	BC-9-70C	BC-9- 70C	080987		2	0.3010	2	0.3010 <	1	0.0000
7567	BC-9-80C	BC-9- 80C	080987		1	0.0000 <	1	0.0000	3	0.4771
7566	BC-9-80C	BC-9- 80C	080987	<	1	0.0000 <	1	0.0000 <	1	0.0000
7569	BC-9-90C	BC-9- 90C	080987		1	0.0000	1	0.0000	3	0.4771

[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]
				MEAN		0.2799	MEAN		0.2277	MEAN		0 1730
				VARIANCE		0.1630	VARIANCE		0.1297	VARIANCE		0 0969
	BC-10-1	BC-10 -1	081087	<	1	0.0000	<	1	0 0000		1	0 0000
	BC-10-10	BC-10 -10	081087	<	1	0.0000	<	1	0.0000	<	1	0.0000
	BC-10-2	BC-10 -2	081087	<	1	0.0000	<	1	0.0000	<	1	0 0000
	BC-10-3	BC-10 -3	081087	<	1	0.0000	<	1	0.0000	<	1	0 0000
	BC-10-4	BC-10 -4	081087	<	1	0.0000	<	1	0.0000	<	1	0.0000
	BC-10-5	BC-10 -5	081087		1	0.0000		1	0.0000	<	1	0 0000
	BC-10-6	BC-10 -6	081087		1	0.0000		1	0.0000	<	1	0.0000
	BC-10-7	BC-10 -7	081087	<	1	0.0000	<	1	0.0000		2	0.3010
	BC-10-8	BC-10 -8	081087		1	0.0000	<	1	0.0000	<	1	0.0000
7702	BC-10-9	BC-10 9	081087		2	0.3010		2	0.3010	<	1	0.0000
	BC-10-11	BC-10 -11	081087	<	1	0.0000	<	1	0.0000		1	0.0000
				MEAN		0.0274	MEAN		0.0274	MEAN		0.0274
				VARIANCE		0.0075	VARIANCE		0.0075	VARIANCE		0.0075
7705	BC-11-1	BC-11 1	081087		1	0.0000	<	1	0.0000		1	0.0000
7714	BC-11-10	BC-11 10	081087	<	1	0.0000	<	1	0.0000	<	1	0.0000
7706	BC-11-2	BC-11 2	081087		1	0.0000	<	1	0.0000		2	0 3010
7707	BC-11-3	BC-11 3	081087	<	1	0.0000	<	1	0.0000	<	1	0.0000
7708	BC-11-4	BC-11 4	081087		2	0.3010		1	0.0000	<	1	0 0000
7709	BC-11-5	BC-11 5	081087	<	1	0.0000	<	1	0.0000		1	0.0000
7710	BC-11-6	BC-11 6	081087	<	1	0.0000	<	1	0.0000	<	1	0.0000
7711	BC-11-7	BC-11 7	081087	<	1	0.0000	<	1	0.0000		1	0.0000
7712	BC-11-8	BC-11 8	081087	<	1	0.0000	<	1	0.0000	<	1	0.0000
7713	BC-11-9	BC-11 9	081087	<	1	0.0000	<	1	0.0000		1	0 0000
7715	BC-11-11	BC-11 11	081087		-2	0.3010		-2	0.3010	<	1	0.0000
7716	BC-11-11R	BC-11 11R	081087		2	0.3010		2	0.3010	<	1	0.0000
				MEAN		0.0547	MEAN		0.0274	MEAN		0.0274
				VARIANCE		0.0135	VARIANCE		0.0075	VARIANCE		0.0075
7766	BC-12-1	BC-12 1	081187		2	0.3010		1	0.0000		1	0.0000
7775	BC-12-10	BC-12 10	081187	<	1	0.0000	<	1	0.0000	<	1	0.0000
7767	BC-12-2	9C-12 2	081187		2	0.30:0		1	0.0000	<	1	0 0000
7768	BC-12-3	BC-12 3	081187		1	0.0000		1	0.0000	<	1	0.0000
7769	BC-12-4	BC-12 4	081187		3	0.4771		3	0.4771	<	1	0 0000
7770	BC-12-5	BC-12 5	081187	<	1	0.0000	<	1	0.0000	<	1	0 0000
7771	BC-12-6	BC-12 6	081187		1	0.0000		1	0.0000	<	1	0 0000
7772	BC-12-7	BC-12 7	081187		7	0.8451		5	0.6990	<	1	0 0000
7773	BC-12-8	BC-12 8	081187		4	0.6021		3	0.4771	<	1	0 0000
7774	BC-12-9	BC-12 9	081187	<	1	0.0000	<	1	0 0000	<	1	0 0000
7776	BC-12-11	BC-12 11	081187		-2	0.3010		-2	0 3010		-2	0 3010

7777	BC-12-11R	BC-12	11R	081187		4	0.6021		2	0.3010		-2	0.3010
					MEAN		0.2570	MEAN		0.1777	MEAN		0.0274
					VARIANCE		0.0772	VARIANCE		0.0625	VARIANCE		0.0075
7129	FPB-1-1	FP-1	-1	080287		170	2.2304		1	0.0000		27	1.4314
7174	FPB-1-10	FP-1	-10	080287		25	1.3979		21	1.3222		41	1.6120
7134	FPB-1-2	FP-1	-2	080287		35	1.5441		27	1.4314		160	2.2041
7139	FPB-1-3	FP-1	-3	080287		15	1.2041		10	1.0000		10	1.0000
7144	FPB-1-4	FP-1	-4	080287		76	1.8808		6	0.7782		[illegible]	1.9294
7149	FPB-1-5	FP-1	-5	080287		120	2.0792		100	2.0000		89	1.9494
7154	FPB-1-6	FP-1	-6	080287		113	2.0531		56	1.7482		137	2.1367
7159	FPB-1-7	FP-1	-7	080287		47	1.6721		37	1.5682		34	1.5315
7164	FPB-1-8	FP-1	-8	080287		32	1.5051		14	1.1461		75	1.8751
7169	FPB-1-9	FP-1	-9	080287		30	1.4771		23	1.3617		49	1.6902
7179	FPB-1-11	FP-1	-11	080287		4	0.6021		1	0.0000		9	0.9542
					MEAN		1.6042	MEAN		1.1233	MEAN		1.6650
					VARIANCE		0.1943	VARIANCE		0.3824	VARIANCE		0.1574
7130	FPB-2-1	FP-2	-1	080287		178	2.2504		68	1.8325		29	1.4624
7175	FPB-2-10	FP-2	-10	080287		72	1.8573		39	1.5911		15	1.1761
7135	FPB-2-2	FP-2	-2	080287		55	1.7404		45	1.6532		54	1.7324
7140	FPB-2-3	FP-2	-3	080287		170	2.2304		66	1.8195		46	1.6628
7145	FPB-2-4	FP-2	-4	080287		170	2.2304		150	2.1761		85	1.9294
7150	FPB-2-5	FP-2	-5	080287		124	2.0934		95	1.9777		38	1.5798
7155	FPB-2-6	FP-2	-6	080287		63	1.7993		38	1.5798		16	1.2041
7160	FPB-2-7	FP-2	-7	080287		1500	3.1761		300	2.4771		97	1.9868
7165	FPB-2-8	FP-2	-8	080287		300	2.4771		140	2.1461		31	1.4914
7170	FPB-2-9	FP-2	-9	080287		160	2.2553		70	1.8451		25	1.3979
7180	FPB-2-11	FP-2	-11	080287		1	0.0000 <		1	0.0000		48	1.6812
					MEAN		2.0100	MEAN		1.7362	MEAN		1.5731
					VARIANCE		0.5437	VARIANCE		0.3694	VARIANCE		0.0624
7131	FPB-3-1	FP-3	-1	080287		480	2.6812		320	2.5051		81	1.9085
7176	FPB-3-10	FP-3	-10	080287		170	2.2304		100	2.0000		62	1.7924
7136	FPB-3-2	FP-3	-2	080287		2200	3.3424		-100	2.0000		45	1.6532
7141	FPB-3-3	FP-3	-3	080287		460	2.6628		320	2.5051		38	1.5798
7146	FPB-3-4	FP-3	-4	080287		106	2.0253		73	1.8633		1590	3.2014
7151	FPB-3-5	FP-3	-5	080287		1500	3.1761		150	2.1761		178	2.2504
7156	FPB-3-6	FP-3	-6	080287		114	2.0569		67	1.8261		100	2.0000
7161	FPB-3-7	FP-3	-7	080287		200	2.3010		100	2.0000		58	1.7634
7166	FPB-3-8	FP-3	-8	080287		92	1.9638		42	1.6232		59	1.7709
7171	FPB-3-9	FP-3	-9	080287		170	2.2304		70	1.8451		39	1.5911
7181	FPB-3-11	FP-3	-11	080287		2	0.3010 <		1	0.0000		41	1.6128
7177	FPB-3-100C	FP-3	-100C	080287		132	2.1206		62	1.7924		39	1.5911

7178	FPB-3-100C	FP-3	-100C	080287	160	2.2041	49	1.6902	80	1.9031
7183	FPB-3-110C	FP-3	-110C	080287	1	0.0000 <	1	0.0000	11	1.0414
7182	FPB-3-110C	FP-3	-110C	080287	1	0.0000 <	1	0.0000	42	1.6232
7133	FPB-3-10C	FP-3	-10C	080287	110	2.0414	50	1.6990	82	1.9138
7132	FPB-3-10C	FP-3	-10C	080287	290	2.4624	180	2.2553	530	2.7243
7137	FPB-3-20C	FP-3	-20C	080287	2900	3.4624	-100	2.0000	53	1.7243
7138	FPB-3-20C	FP-3	-20C	080287	2600	3.4150	-100	2.0000	38	1.5798
7142	FPB-3-30C	FP-3	-30C	080287	140	2.1461	68	1.8325	23	1.3617
7143	FPB-3-30C	FP-3	-30C	080287	100	2.0000	33	1.5185	46	1.6628
7147	FPB-3-40C	FP-3	-40C	080287	81	1.9085	67	1.8261	4500	3.6532
7148	FPB-3-40C	FP-3	-40C	080287	47	1.6721	34	1.5315	5000	3.6990
7152	FPB-3-50C	FP-3	-50C	080287	1140	3.0569	200	2.3010	150	2.1761
7153	FPB-3-50C	FP-3	-50C	080287	1140	3.0569	300	2.4771	1243	3.0945
7157	FPB-3-60C	FP-3	-60C	080287	113	2.0531	64	1.8062	58	1.7634
7158	FPB-3-60C	FP-3	-60C	080287	104	2.0170	85	1.9294	138	2.1399
7162	FPB-3-70C	FP-3	-70C	080287	-100	2.0000	-100	2.0000	24	1.3802
7163	FPB-3-70C	FP-3	-70C	080287	180	2.2553	100	2.0000	16	1.2041
7167	FPB-3-80C	FP-3	-80C	080287	72	1.8573	25	1.3979	29	1.4624
7168	FPB-3-80C	FP-3	-80C	080287	95	1.9777	35	1.5441	69	1.8388
7173	FPB-3-90C	FP-3	-90C	080287	160	2.2041	60	1.7782	27	1.4314
7172	FPB-3-90C	FP-3	-90C	080287	230	2.3617	100	2.0000	77	1.8865
					MEAN	2.2701	MEAN	1.8495	MEAN	1.9203
					VARIANCE	0.5795	VARIANCE	0.4097	VARIANCE	0.2009
7324	FPB-4-1	FP-4	-1	080387	260	2.4150	120	2.0792	32	1.5051
7333	FPB-4-10	FP-4	-10	080387	156	2.1931	36	1.5563	14	1.1461
7325	FPB-4-2	FP-4	-2	080387	120	2.0792	20	1.3010	8	0.9031
7326	FPB-4-3	FP-4	-3	080387	180	2.2553	80	1.9031	12	1.0792
7327	FPB-4-4	FP-4	-4	080387	880	2.9445	210	2.3222	78	1.8921
7328	FPB-4-5	FP-4	-5	080387	160	2.2041	40	1.6021	73	1.8633
7329	FPB-4-6	FP-4	-6	080387	160	2.2041	40	1.6021	18	1.2553
7330	FPB-4-7	FP-4	-7	080387	130	2.1139	30	1.4771	11	1.0414
7331	FPB-4-8	FP-4	-8	080387	176	2.2455	44	1.6435	8	0.9031
7332	FPB-4-9	FP-4	-9	080387	130	2.1139	10	1.0000	34	1.5315
7334	FPB-4-11	FP-4	-11	080387	28	1.4472	28	1.4472	44	1.6435
					MEAN	2.2769	MEAN	1.6487	MEAN	1.3120
					VARIANCE	0.0576	VARIANCE	0.1288	VARIANCE	0.1219
7313	FPB-5-1	FP-5	-1	080387	440	2.6435	120	2.0792	16	1.2041
7322	FPB-5-10	FP-5	-10	080387	250	2.3979	160	2.2041	14	1.1461
7314	FPB-5-2	FP-5	-2	080387	210	2.3222	150	2.1761	15	1.1761
7315	FPB-5-3	FP-5	-3	080387	580	2.7634	190	2.2788	18	1.2553
7316	FPB-5-4	FP-5	-4	080387	240	2.3802	80	1.9031	31	1.4914
7317	FPB-5-5	FP-5	-5	080387	120	2.0792	30	1.4771	15	1.1761
7318	FPB-5-6	FP-5	-6	080387	114	2.0569	60	1.7782	12	1.0792
7319	FPB-5-7	FP-5	-7	080387	230	2.3617	70	1.8451	20	1.3010

7320	FPB-5-8	FP-5	-8	080387		120	2.0792		20	1.3010		6	0.7782
7321	FPB-5-9	FP-5	-9	080387		100	2.0000		30	1.4771		24	1.3802
7323	FPB-5-11	FP-5	-11	080387		-10	1.0000		-10	1.0000		-2	0.3010
					MEAN		2.1895	MEAN		1.7745	MEAN		1.1172
					VARIANCE		0.1959	VARIANCE		0.1559	VARIANCE		0.0764
7362	FPB-6-1	FP-6	-1	080487		300	2.4771		190	2.2788		16	1.2041
7371	FPB-6-10	FP-6	-10	080487		310	2.4914		200	2.3010		4	0.6021
7363	FPB-6-2	FP-6	-2	080487		280	2.4472		170	2.2304		6	0.7782
7364	FPB-6-3	FP-6	-3	080487		8600	3.9345		8300	3.9191		290	2.4624
7365	FPB-6-4	FP-6	-4	080487		200	2.3010		130	2.1139		5	0.6990
7366	FPB-6-5	FP-6	-5	080487		260	2.4150		110	2.0414		19	1.2788
7367	FPB-6-6	FP-6	-6	080487		130	2.1139		70	1.8451		4	0.6021
7368	FPB-6-7	FP-6	-7	080487		280	2.4472		140	2.1461		5	0.6990
7369	FPB-6-8	FP-6	-8	080487		380	2.5798		120	2.0792		3	0.4771
7370	FPB-6-9	FP-6	-9	080487		230	2.3617		140	2.1461		6	0.7782
7372	FPB-6-11	FP-6	-11	080487		20	1.3010		20	1.3010 <		1	0.0000
					MEAN		2.4427	MEAN		2.2184	MEAN		0.8710
					VARIANCE		0.3352	VARIANCE		0.3596	VARIANCE		0.3586
7482	FPB-7-1	FP-7	-1	080887		32	1.5051		29	1.4624		2	0.3010
7491	FPB-7-10	FP-7	-10	080887		47	1.6721		26	1.4150 <		1	0.0000
7483	FPB-7-2	FP-7	-2	080887		28	1.4472		21	1.3222		1	0.0000
7484	FPB-7-3	FP-7	-3	080887		56	1.7482		25	1.3979		1	0.0000
7485	FPB-7-4	FP-7	-4	080887		75	1.8751		58	1.7634 <		1	0.0000
7486	FPB-7-5	FP-7	-5	080887		76	1.8808		51	1.7076		1	0.0000
7487	FPB-7-6	FP-7	-6	080887		59	1.7709		16	1.2041		1	0.0000
7488	FPB-7-7	FP-7	-7	080887		64	1.8062		37	1.5682		1	0.0000
7489	FPB-7-8	FP-7	-8	080887		43	1.6335		38	1.5798		1	0.0000
7490	FPB-7-9	FP-7	-9	080887		46	1.6628		17	1.2304 <		1	0.0000
7492	FPB-7-11	FP-7	-11	080887		7	0.8451		6	0.7782 <		1	0.0000
					MEAN		1.6224	MEAN		1.4027	MEAN		0.0274
					VARIANCE		0.0777	VARIANCE		0.0683	VARIANCE		0.0075
7579	FPB-8-1	FP-8	-1	080987		99	1.9956		16	1.2041		1800	3.2553
7588	FPB-8-10	FP-8	-10	080987		59	1.7709		20	1.3010		300	2.4771
7580	FPB-8-2	FP-8	-2	080987		145	2.1614		46	1.6628		440	2.6435
7581	FPB-8-3	FP-8	-3	080987		180	2.2553		44	1.6435		530	2.7243
7582	FPB-8-4	FP-8	-4	080987		60	1.7782		28	1.4472		1200	3.0792
7583	FPB-8-5	FP-8	-5	080987		121	2.0828		57	1.7559		300	2.4771
7584	FPB-8-6	FP-8	-6	080987		88	1.9445		18	1.2553		400	2.6021
7585	FPB-8-7	FP-8	-7	080987		67	1.8261		14	1.1461		300	2.4771
7586	FPB-8-8	FP-8	-8	080987		115	2.0607		22	1.3424		500	2.6990
7587	FPB-8-9	FP-8	-9	080987		48	1.6812		22	1.3424		400	2.6021

7589	FPB-8-11	FP-8	-11	080987	19	1.2788	3	0.4771	400	2.6021
					MEAN	1.8941	MEAN	1.3253	MEAN	2.6944
					VARIANCE	0.0668	VARIANCE	0.1080	VARIANCE	0.0576
7590	FPB-9-1	FP-9	-1	080987	78	1.8921	30	1.4771	200	2.3010
7617	FPB-9-10	FP-9	-10	080987	80	1.9031	40	1.6021	26	1.4150
7593	FPB-9-2	FP-9	-2	080987	34	1.5315	29	1.4624	28	1.4472
7596	FPB-9-3	FP-9	-3	080987	105	2.0212	6	0.7782	29	1.4624
7599	FPB-9-4	FP-9	-4	080987	61	1.7853	40	1.6021	25	1.3979
7602	FPB-9-5	FP-9	-5	080987	230	2.3617	190	2.2788	50	1.6990
7605	FPB-9-6	FP-9	-6	080987	51	1.7076	29	1.4624	71	1.8513
7608	FPB-9-7	FP-9	-7	080987	760	2.8808	640	2.8062	23	1.3617
7611	FPB-9-8	FP-9	-8	080987	140	2.1461	23	1.3617	27	1.4314
7614	FPB-9-9	FP-9	-9	080987	77	1.8865	77	1.8865	29	1.4624
7620	FPB-9-11	FP-9	-11	080987	6	0.7782	4	0.6021	220	2.3424
7616	FPB-9-90C	FP-9	-90C	080987	69	1.8388	69	1.8388	37	1.5682
7615	FPB-9-90C	FP-9	-90C	080987	71	1.8513	71	1.8513	63	1.7993
7618	FPB-9-100C	FP-9	-100C	080987	50	1.6990	40	1.6021	34	1.5315
7619	FPB-9-100C	FP-9	-100C	080987	520	2.7160	370	2.5682	2500	3.3979
7621	FPB-9-110C	FP-9	-110C	080987	2	0.3010	2	0.3010	26	1.4150
7622	FPB-9-110C	FP-9	-110C	080987	4	0.6021	2	0.3010	200	2.3010
7624	FPB-9-110CR	FP-9	-110CR	080987	6	0.7782	2	0.3010	208	2.3181
7623	FPB-9-110CR	FP-9	-110CR	080987	4	0.6021	2	0.3010	26	1.4150
7592	FPB-9-10C	FP-9	-10C	080987	85	1.9294	54	1.7324	23	1.3617
7591	FPB-9-10C	FP-9	-10C	080987	88	1.9445	34	1.5315	32	1.5051
7595	FPB-9-20C	FP-9	-20C	080987	64	1.8062	60	1.7782	21	1.3222
7594	FPB-9-20C	FP-9	-20C	080987	69	1.8388	34	1.5315	15	1.1761
7598	FPB-9-30C	FP-9	-30C	080987	62	1.7924	22	1.3424	16	1.2041
7597	FPB-9-30C	FP-9	-30C	080987	81	1.9085	42	1.6232	25	1.3979
7600	FPB-9-40C	FP-9	-40C	080987	51	1.7076	27	1.4314	79	1.8976
7601	FPB-9-40C	FP-9	-40C	080987	83	1.9191	35	1.5441	26	1.4150
7604	FPB-9-50C	FP-9	-50C	080987	160	2.2041	140	2.1461	70	1.8451
7603	FPB-9-50C	FP-9	-50C	080987	160	2.2041	140	2.1461	74	1.8692
7607	FPB-9-60C	FP-9	-60C	080987	52	1.7160	39	1.5911	1	0.0000
7606	FPB-9-60C	FP-9	-60C	080987	56	1.7482	29	1.4624	26	1.4150
7609	FPB-9-70C	FP-9	-70C	080987	830	2.9191	730	2.8633	10	1.0000
7610	FPB-9-70C	FP-9	-70C	080987	890	2.9494	860	2.9345	12	1.0792
7612	FPB-9-80C	FP-9	-80C	080987	130	2.1139	64	1.8062	18	1.2553
7613	FPB-9-80C	FP-9	-80C	080987	128	2.1072	68	1.8325	21	1.3222
					MEAN	1.8995	MEAN	1.5745	MEAN	1.6520
					VARIANCE	0.2450	VARIANCE	0.3429	VARIANCE	0.1189
7721	FPB-10-5	FP-10	-5	081087	90	1.9542	14	1.1461	170	2.2304
7720	FPB-10-4	FP-10	-4	081087	52	1.7160	16	1.2041	170	2.2304
7722	FPB-10-6	FP-10	-6	081087	68	1.8325	26	1.4150	120	2.0792
7723	FPB-10-7	FP-10	-7	081087	70	1.8451	28	1.4472	180	2.2553

7726	FP8-10-10	FP-10 -10	081087		118	2.0719		24	1.3802		136	2.1335
7725	FP8-10-9	FP-10 -9	081087		84	1.9243		26	1.4150		72	1.8573
7717	FB8-10-1	FP-10 -1	081087		70	1.8451		16	1.2041		370	2.5682
7724	FP8-10-8	FP-10 -8	081087		128	2.1072		46	1.6628		134	2.1271
7718	FP-10-2	FP-10 -2	081087		60	1.7782		14	1.1461		290	2.4624
7719	FP-10-3	FP-10 -3	081087		48	1.6812		16	1.2041		250	2.3979
7727	FP8-10-11	FP-10 -11	081087		4	0.6021		-2	0.3010		60	1.7782
				MEAN		1.8756	MEAN		1.3225	MEAN		2.2342
				VARIANCE		0.0177	VARIANCE		0.0256	VARIANCE		0.0379
7735	FP8-11-8	FP-11 -8	081087		50	1.6990		22	1.3424		820	2.9138
7736	FP8-11-9	FP-11 -9	081087		64	1.8062		18	1.2553		3200	3.5051
7737	FP8-11-10	FP-11 -10	081087		70	1.8451		18	1.2553		6200	3.7924
7729	FP8-11-2	FP-11 -2	081087		52	1.7160		20	1.3010		120	2.0792
7734	FP8-11-7	FP-11 -7	081087		36	1.5563		14	1.1461		150	2.1761
7730	FP8-11-3	FP-11 -3	081087		58	1.7634		16	1.2041		88	1.9445
7733	FP8-11-6	FP-11 -6	081087		62	1.7924		20	1.3010		128	2.1072
7728	FP8-11-1	FP-11 -1	081087		284	2.4533		54	1.7324		310	2.4914
7731	FP8-11-4	FP-11 -4	081087		54	1.7324		22	1.3424		122	2.0864
7732	FP8-11-5	FP-11 -5	081087		52	1.7160		20	1.3010		115	2.0607
7738	FP8-11-11	FP-11 -11	081087		6	0.7782		-2	0.3010		1180	3.0719
7739	FP8-11-11R	FP-11 -11R	081087		4	0.6021		2	0.3010		1170	3.0682
				MEAN		1.7144	MEAN		1.2257	MEAN		2.5662
				VARIANCE		0.1347	VARIANCE		0.1059	VARIANCE		0.3854
7782	FP8-12-5	FP-12 -5	081187		60	1.7782		38	1.5798		116	2.0645
7787	FP8-12-10	FP-12 -10	081187		52	1.7160		19	1.2788		82	1.9138
7778	FP8-12-1	FP-12 -1	081187		550	2.7404		390	2.5911		64	1.8062
7785	FP8-12-8	FP-12 -8	081187		50	1.6990		30	1.4771		220	2.3424
7779	FP8-12-2	FP-12 -2	081187		83	1.9191		26	1.4150		48	1.6812
7783	FP8-12-6	FP-12 -6	081187		42	1.6232		34	1.5315		83	1.9191
7786	FP8-12-9	FP-12 -9	081187		60	1.7782		25	1.3979		70	1.8451
7781	FP8-12-4	FP-12 -4	081187		340	2.5315		145	2.1614		81	1.9085
7784	FP8-12-7	FP-12 -7	081187		74	1.8692		21	1.3222		142	2.1523
7780	FP8-12-3	FP-12 -3	081187		73	1.8633		53	1.7243		62	1.7924
7788	FP8-12-11	FP-12 -11	081187		34	1.5315		15	1.1761		220	2.3424
				MEAN		1.9136	MEAN		1.6050	MEAN		1.9789
				VARIANCE		0.1293	VARIANCE		0.1607	VARIANCE		0.0441
7184	LB-1-1	LB-1- 1	080287		28	1.4472		11	1.0414		19	1.2788
7229	LB-1-10	LB-1- 10	080287		11	1.0414		9	0.9542		33	1.5185
7189	LB-1-2	LB-1- 2	080287		16	1.2041		4	0.6021		41	1.6128
7194	LB-1-3	LB-1- 3	080287		12	1.0792		10	1.0000		14	1.1461
7199	LB-1-4	LB-1- 4	080287		8	0.9031		6	0.7782		11	1.0414
7204	LB-1-5	LB-1- 5	080287		11	1.0414		9	0.9542		21	1.3222

7209 LB-1-6	LB-1- 6	080287	4	0.6021	1	0.0000	102	2.0086
7214 LB-1-7	LB-1- 7	080287	3	0.4771	3	0.4771	15	1.1761
7219 LB-1-8	LB-1- 8	080287	3	0.4771	2	0.3010	11	1.0414
7224 LB-1-9	LB-1- 9	080287	1	0.0000	1	0.0000	25	1.3979
7234 LB-1-11	LB-1- 11	080287	2	0.3010	2	0.3010	-2	0.3010
7241 LB-1-11R	LB-1- 11R	080287	-2	0.3010	-2	0.3010	2	0.3010
			MEAN	0.7794	MEAN	0.5827	MEAN	1.2586
			VARIANCE	0.1745	VARIANCE	0.1407	VARIANCE	0.1646
7185 LB-2-1	LB-2- 1	080287	60	1.7782	26	1.4150	52	1.7160
7230 LB-2-10	LB-2- 10	080287	4	0.6021	4	0.6021	51	1.7076
7190 LB-2-2	LB-2- 2	080287	28	1.4472	16	1.2041	52	1.7160
7195 LB-2-3	LB-2- 3	080287	6	0.7782	4	0.6021	113	2.0531
7200 LB-2-4	LB-2- 4	080287	1	0.0000	1	0.0000	48	1.6812
7205 LB-2-5	LB-2- 5	080287	9	0.9542	6	0.7782	42	1.6232
7210 LB-2-6	LB-2- 6	080287	5	0.6990	1	0.0000	58	1.7634
7215 LB-2-7	LB-2- 7	080287	9	0.9542	5	0.6990	44	1.6435
7220 LB-2-8	LB-2- 8	080287	4	0.6021	1	0.0000	22	1.3424
7225 LB-2-9	LB-2- 9	080287	3	0.4771	1	0.0000	50	1.6990
7235 LB-2-11	LB-2- 11	080287	2	0.3010	2	0.3010	42	1.6232
7242 LB-2-11R	LB-2- 11R	080287	-2	0.3010	-2	0.3010	46	1.6628
			MEAN	0.7812	MEAN	0.5092	MEAN	1.6881
			VARIANCE	0.2274	VARIANCE	0.2281	VARIANCE	0.0246
7186 LB-3-1	LB-3- 1	080287	1090	3.0374	900	2.9542	76	1.8808
7231 LB-3-10	LB-3- 10	080287	3	0.4771	2	0.3010	70	1.8451
7191 LB-3-2	LB-3- 2	080287	620	2.7924	420	2.6232	2240	3.3502
7196 LB-3-3	LB-3- 3	080287	73	1.8633	51	1.7076	780	2.8921
7201 LB-3-4	LB-3- 4	080287	62	1.7924	59	1.7709	170	2.2304
7206 LB-3-5	LB-3- 5	080287	150	2.1761	120	2.0792	187	2.2718
7211 LB-3-6	LB-3- 6	080287	150	2.1761	100	2.0000	620	2.7924
7216 LB-3-7	LB-3- 7	080287	410	2.6128	220	2.3424	270	2.4314
7221 LB-3-8	LB-3- 8	080287	96	1.9823	46	1.6628	62	1.7924
7226 LB-3-9	LB-3- 9	080287	28	1.4472	17	1.2304	67	1.8261
7236 LB-3-11	LB-3- 11	080287	2	0.3010	2	0.3010	56	1.7482
7228 LB-3-9OC	LB-3- 9OC	080287	37	1.5682	23	1.3617	4	0.6021
7227 LB-3-9OC	LB-3- 9OC	080287	38	1.5798	17	1.2304	92	1.9638
7232 LB-3-10OC	LB-3- 10OC	080287	8	0.9031	4	0.6021	80	1.9031
7233 LB-3-10OC	LB-3- 10OC	080287	12	1.0792	8	0.9031	110	2.0414
7240 LB-3-10OCR	LB-3- 10OCR	080287	10	1.0000	6	0.7782	104	2.0170
7239 LB-3-10OCR	LB-3- 10OCR	080287	2	0.3010	2	0.3010	70	1.8451
7237 LB-3-11OC	LB-3- 11OC	080287	-2	0.3010	-2	0.3010	224	2.3502
7238 LB-3-11OC	LB-3- 11OC	080287	2	0.3010	2	0.3010	94	1.9731
7244 LB-3-11OCR	LB-3- 11OCR	080287	-2	0.3010	-2	0.3010	230	2.3617
7245 LB-3-11OCR	LB-3- 11OCR	080287	-2	0.3010	-2	0.3010	74	1.8692
7243 LB-3-11R	LB-3- 11R	080287	-2	0.3010	-2	0.3010	86	1.9345

7187 LB-3-10C	LB-3- 10C	080287	720	2.8573	720	2.8573	810	2.9085
7188 LB-3-10C	LB-3- 10C	080287	610	2.7853	500	2.6990	1230	3.0099
7193 LB-3-20C	LB-3- 20C	080287	320	2.5051	320	2.5051	621	2.7931
7192 LB-3-20C	LB-3- 20C	080287	450	2.6532	450	2.6532	680	2.8325
7197 LB-3-30C	LB-3- 30C	080287	90	1.9542	63	1.7993	56	1.7482
7198 LB-3-30C	LB-3- 30C	080287	108	2.0334	85	1.9294	107	2.0294
7202 LB-3-40C	LB-3- 40C	080287	61	1.7853	31	1.4914	570	2.7559
7203 LB-3-40C	LB-3- 40C	080287	91	1.9590	28	1.4472	930	2.9685
7207 LB-3-50C	LB-3- 50C	080287	100	2.0000	100	2.0000	189	2.2765
7208 LB-3-50C	LB-3- 50C	080287	120	2.0792	110	2.0414	64	1.8062
7213 LB-3-60C	LB-3- 60C	080287	180	2.2553	100	2.0000	157	2.1959
7212 LB-3-60C	LB-3- 60C	080287	180	2.2553	100	2.0000	260	2.4150
7218 LB-3-70C	LB-3- 70C	080287	400	2.6021	170	2.2304	168	2.2253
7217 LB-3-70C	LB-3- 70C	080287	420	2.6232	260	2.4150	146	2.1644
7223 LB-3-80C	LB-3- 80C	080287	77	1.8865	54	1.7324	175	2.2430
7222 LB-3-80C	LB-3- 80C	080287	67	1.8261	50	1.6990	53	1.7243
			MEAN	1.8780	MEAN	1.7248	MEAN	2.2783
			VARIANCE	0.6865	VARIANCE	0.6551	VARIANCE	0.2621
7335 LB-4-1	LB-4- 1	080387	620	2.7924	310	2.4914	10	1.0000
7344 LB-4-10	LB-4- 10	080387	67	1.8261	36	1.5563	91	1.9590
7336 LB-4-2	LB-4- 2	080387	240	2.3802	100	2.0000	88	1.9445
7337 LB-4-3	LB-4- 3	080387	48	1.6812	32	1.5051	32	1.5051
7338 LB-4-4	LB-4- 4	080387	133	2.1239	102	2.0086	10	1.0000
7339 LB-4-5	LB-4- 5	080387	116	2.0645	92	1.9638	2	0.3010
7340 LB-4-6	LB-4- 6	080387	111	2.0453	79	1.8976	3	0.4771
7341 LB-4-7	LB-4- 7	080387	42	1.6232	42	1.6232	4	0.6021
7342 LB-4-8	LB-4- 8	080387	39	1.5911	20	1.3010	32	1.5051
7343 LB-4-9	LB-4- 9	080387	30	1.4771	24	1.3802	13	1.1139
7345 LB-4-11	LB-4- 11	080387	34	1.5315	17	1.2304	7	0.8451
			MEAN	1.9215	MEAN	1.7234	MEAN	1.1139
			VARIANCE	0.1509	VARIANCE	0.1328	VARIANCE	0.2852
7346 LB-5-1	LB-5- 1	080387	120	2.0792	58	1.7634	29	1.4624
7355 LB-5-10	LB-5- 10	080387	120	2.0792	100	2.0000	20	1.3010
7347 LB-5-2	LB-5- 2	080387	60	1.7782	33	1.5185	25	1.3979
7348 LB-5-3	LB-5- 3	080387	65	1.8129	25	1.3979	25	1.3979
7349 LB-5-4	LB-5- 4	080387	124	2.0934	68	1.8325	19	1.2788
7350 LB-5-5	LB-5- 5	080387	124	2.0934	68	1.8325	16	1.2041
7351 LB-5-6	LB-5- 6	080387	78	1.8921	68	1.8325	18	1.2553
7352 LB-5-7	LB-5- 7	080387	124	2.0934	70	1.8451	16	1.2041
7353 LB-5-8	LB-5- 8	080387	130	2.1139	60	1.7702	12	1.0792
7354 LB-5-9	LB-5- 9	080387	146	2.1644	62	1.7924	7	0.8451
7356 LB-5-11	LB-5- 11	080387	-2	0.3010	-2	0.3010	2	0.3010
7357 LB-5-10R	LB-5- 10R	080387	80	1.9031	50	1.6990	20	1.3010
7358 LB-5-11R	LB-5- 11R	080387	6	0.7782	6	0.7782	-2	0.3010

				MEAN VARIANCE	1.8637 0.2597	MEAN VARIANCE	1.6267 0.2004	MEAN VARIANCE	1.1570 0.0996
7380	LB_6-8	LB-6- 8	080487	60	1.7782	60	1.7782	2	0.3010
7373	LB-6-1	LB-6- 1	080487	80	1.9031	80	1.9031	2	0.3010
7382	LB-6-10	LB-6- 10	080487	20	1.3010	20	1.3010	2	0.3010
7374	LB-6-2	LB-6- 2	080487	70	1.8451	70	1.8451 <	1	0.0000
7375	LB-6-3	LB-6- 3	080487	50	1.6990	50	1.6990 <	1	0.0000
7376	LB-6-4	LB-6- 4	080487	20	1.3010	20	1.3010 <	1	0.0000
7377	LB-6-5	LB-6- 5	080487	30	1.4771	20	1.3010	2	0.3010
7378	LB-6-6	LB-6- 6	080487	30	1.4771	30	1.4771 <	1	0.0000
7379	LB-6-7	LB-6- 7	080487	40	1.6021	40	1.6021	2	0.3010
7381	LB-6-9	LB-6- 9	080487	40	1.6021	40	1.6021 <	1	0.0000
7383	LB-6-11	LB-6- 11	080487	-2	0.3010	-2	0.3010 <	1	0.0000
7384	LB-6-11R	LB-6- 11R	080487	2	0.3010	2	0.3010 <	1	0.0000
				MEAN VARIANCE	1.4806 0.1757	MEAN VARIANCE	1.4646 0.1784	MEAN VARIANCE	0.1369 0.0225
7493	LB-7-1	LB-7- 1	080887	15	1.1761	3	0.4771	3	0.4771
7502	LB-7-10	LB-7- 10	080887	58	1.7634	26	1.4150	2	0.3010
7494	LB-7-2	LB-7- 2	080887	31	1.4914	10	1.0000	1	0.0000
7495	LB-7-3	LB-7- 3	080887	29	1.4624	24	1.3802 <	1	0.0000
7496	LB-7-4	LB-7- 4	080887	83	1.9191	57	1.7559	2	0.3010
7497	LB-7-5	LB-7- 5	080887	95	1.9777	50	1.6990	2	0.3010
7498	LB-7-6	LB-7- 6	080887	19	1.2788	19	1.2788	1	0.0000
7499	LB-7-7	LB-7- 7	080887	38	1.5798	24	1.3802	2	0.3010
7500	LB-7-8	LB-7- 8	080887	63	1.7993	19	1.2788	1	0.0000
7501	LB-7-9	LB-7- 9	080887	10	1.0000	8	0.9031	2	0.3010
7503	LB-7-11	LB-7- 11	080887	2	0.3010	2	0.3010	2	0.3010
7504	LB-7-11R	LB-7- 11R	080887	2	0.3010	2	0.3010	-2	0.3010
				MEAN VARIANCE	1.4317 0.2146	MEAN VARIANCE	1.1699 0.1937	MEAN VARIANCE	0.2076 0.0270
7625	LB-8-1	LB-8- 1	080987	44	1.6435	28	1.4472	200	2.3010
7634	LB-8-10	LB-8- 10	080987	16	1.2041	12	1.0792	200	2.3010
7626	LB-8-2	LB-8- 2	080987	29	1.4624	15	1.1761	200	2.3010
7627	LB-8-3	LB-8- 3	080987	28	1.4472	18	1.2553	100	2.0000
7628	LB-8-4	LB-8- 4	080987	48	1.6812	25	1.3979	300	2.4771
7629	LB-8-5	LB-8- 5	080987	60	1.7782	39	1.5911	500	2.6990
7630	LB-8-6	LB-8- 6	080987	62	1.7924	10	1.0000	200	2.3010
7631	LB-8-7	LB-8- 7	080987	17	1.2304	9	0.9542	200	2.3010
7632	LB-8-8	LB-8- 8	080987	28	1.4472	9	0.9542	200	2.3010
7633	LB-8-9	LB-8- 9	080987	18	1.2553	8	0.9031	200	2.3010
7635	LB-8-11	LB-8- 11	080987	48	1.6812	10	1.0000	200	2.3010

			MEAN		1.5117	MEAN	1.1590	MEAN	2.3256
			VARIANCE		0.0432	VARIANCE	0.0493	VARIANCE	0.0248
7636 LB-9-1	LB-9- 1	080987		65	1.8129	47	1.6721	9	0.9542
7663 LB-9-10	LB-9- 10	080987		8	0.9031	7	0.8451	19	1.2788
7639 LB-9-2	LB-9- 2	080987		35	1.5441	22	1.3424	13	1.1139
7642 LB-9-3	LB-9- 3	080987		158	2.1987	105	2.0212	3	0.4771
7645 LB-9-4	LB-9- 4	080987		34	1.5315	16	1.2041	15	1.1761
7648 LB-9-5	LB-9- 5	080987		38	1.5778	25	1.3979	21	1.3222
7651 LB-9-6	LB-9- 6	080987		9	0.9542	8	0.9031	200	2.3010
7654 LB-9-7	LB-9- 7	080987		15	1.1761	5	0.6990	9	0.9542
7660 LB-9-9	LB-9- 9	080987		7	0.8451	4	0.6021	200	2.3010
7657 LB-9-8	LB-9- 8	080987		10	1.0000	9	0.9542	15	1.1761
7666 LB-9-11	LB-9- 11	080987		1	0.0000	1	0.0000	77	1.8865
7664 LB-9-100C	LB-9- 100C	080987		1	0.0000	1	0.0000	69	1.8388
7665 LB-9-100C	LB-9- 100C	080987		10	1.0000	3	0.4771	47	1.6721
7668 LB-9-110C	LB-9- 110C	080987		-2	0.3010	-2	0.3010	98	1.9912
7667 LB-9-110C	LB-9- 110C	080987		-2	0.3010	-2	0.3010	90	1.9542
7669 LB-9-110CR	LB-9- 110CR	080987		-2	0.3010	-2	0.3010	80	1.9031
7670 LB-9-110CR	LB-9- 110CR	080987		-2	0.3010	-2	0.3010	114	2.0569
7637 LB-9-10C	LB-9- 10C	080987		50	1.6990	35	1.5441	3	0.4771
7638 LB-9-10C	LB-9- 10C	080987		48	1.6812	36	1.5563	300	2.4771
7640 LB-9-20C	LB-9- 20C	080987		28	1.4472	19	1.2788	5	0.6990
7641 LB-9-20C	LB-9- 20C	080987		25	1.3979	16	1.2041	400	2.6021
7644 LB-9-30C	LB-9- 30C	080987		128	2.1072	94	1.9731	3	0.4771
7643 LB-9-30C	LB-9- 30C	080987		113	2.0531	77	1.8865	12	1.0792
7647 LB-9-40C	LB-9- 40C	080987		34	1.5315	22	1.3424	18	1.2553
7646 LB-9-40C	LB-9- 40C	080987		40	1.6021	29	1.4624	30	1.4771
7649 LB-9-50C	LB-9- 50C	080987		37	1.5682	26	1.4150	22	1.3424
7650 LB-9-50C	LB-9- 50C	080987		30	1.4771	24	1.3802	19	1.2788
7652 LB-9-60C	LB-9- 60C	080987		7	0.8451	5	0.6990	200	2.3010
7653 LB-9-60C	LB-9- 60C	080987		10	1.0000	8	0.9031	2	0.3010
7655 LB-9-70C	LB-9- 70C	080987		15	1.1761	9	0.9542	20	1.3010
7656 LB-9-70C	LB-9- 70C	080987		12	1.0792	6	0.7782	45	1.6532
7659 LB-9-80C	LB-9- 80C	080987		11	1.0414	11	1.0414	13	1.1139
7658 LB-9-80C	LB-9- 80C	080987		8	0.9031	8	0.9031	65	1.8129
7662 LB-9-90C	LB-9- 90C	080987		10	1.0000	9	0.9542	300	2.4771
7661 LB-9-90C	LB-9- 90C	080987		4	0.6021	4	0.6021	32	1.5051
			MEAN		1.2314	MEAN	1.0583	MEAN	1.3583
			VARIANCE		0.3172	VARIANCE	0.2781	VARIANCE	0.2994
7671 LB-10-1	LB-10 -1	081087		53	1.7243	35	1.5441	240	2.3802
7680 LB-10-10	LB-10 -10	081087		9	0.9542	7	0.8451	170	2.2304
7672 LB-10-2	LB-10 -2	081087		56	1.7482	50	1.6990	64	1.8062
7673 LB-10-3	LB-10 -3	081087		26	1.4150	26	1.4150	170	2.2304
7674 LB-10-4	LB-10 -4	081087		41	1.6128	41	1.6128	180	2.2553

7675	LB-10-5	LB-10 -5	081087	16	1.2041	13	1.1139	3500	3.5441
7676	LB-10-6	LB-10 -6	081087	25	1.3979	15	1.1761	90	1.9542
7677	LB-10-7	LB-10 -7	081087	17	1.2304	6	0.7782	1700	3.2304
7678	LB-10-8	LB-10 -8	081087	8	0.9031	8	0.9031	87	1.9395
7679	LB-10-9	LB-10 -9	081087	27	1.4314	20	1.3010	121	2.0828
7681	LB-10-11	LB-10 -11	081087	2	0.3010	1	0.0000	210	2.3222
				MEAN	1.2657	MEAN	1.1262	MEAN	2.3614
				VARIANCE	0.1632	VARIANCE	0.2158	VARIANCE	0.2665
7682	LB-11-1	LB-11 -1	081087	35	1.5441	23	1.3617	170	2.0792
7691	LB-11-10	LB-11 -10	081087	10	1.0000	4	0.6021	76	1.8808
7683	LB-11-2	LB-11 -2	081087	61	1.7853	43	1.6335	140	2.1461
7684	LB-11-3	LB-11 -3	081087	46	1.6628	28	1.4472	150	2.1761
7685	LB-11-4	LB-11 -4	081087	18	1.2553	10	1.0000	230	2.3617
7686	LB-11-5	LB-11 -5	081087	11	1.0414	8	0.9031	200	2.3010
7687	LB-11-6	LB-11 -6	081087	5	0.6990	5	0.6990	130	2.1139
7688	LB-11-7	LB-11 -7	081087	6	0.7782	4	0.6021	200	2.3010
7689	LB-11-8	LB-11 -8	081087	5	0.6990	5	0.6990	91	1.9590
7690	LB-11-9	LB-11 -9	081087	6	0.7782	4	0.6021	140	2.1461
7692	LB-11-11	LB-11 -11	081087	-2	0.3010	-2	0.3010	1050	3.0212
7693	LB-11-11R	LB-11 -11R	081087	-2	0.3010	-2	0.3010	1500	3.1761
				MEAN	1.0495	MEAN	0.8955	MEAN	2.2260
				VARIANCE	0.1964	VARIANCE	0.1606	VARIANCE	0.0820
7789	LB-12-1	LB-12 -1	081187	50	1.6990	5	0.6990	75	1.8751
7798	LB-12-10	LB-12 -10	081187	32	1.5051	16	1.2041	34	1.5315
7790	LB-12-2	LB-12 -2	081187	86	1.9345	23	1.3617	78	1.8921
7791	LB-12-3	LB-12 -3	081187	41	1.6128	12	1.0792	68	1.8325
7792	LB-12-4	LB-12 -4	081187	30	1.4771	13	1.1139	45	1.6532
7793	LB-12-5	LB-12 -5	081187	51	1.7076	14	1.1461	63	1.7993
7794	LB-12-6	LB-12 -6	081187	34	1.5315	10	1.0000	50	1.6990
7795	LB-12-7	LB-12 -7	081187	54	1.7324	15	1.1761	80	1.9031
7796	LB-12-8	LB-12 -8	081187	39	1.5911	3	0.4771	61	1.7853
7797	LB-12-9	LB-12 -9	081187	35	1.5441	13	1.1139	43	1.6335
7799	LB-12-11	LB-12 -11	081187	106	2.0253	14	1.1461	156	2.1931
7800	LB-12-11R	LB-12 -11R	081187	120	2.0792	6	0.7782	132	2.1206
				MEAN	1.6691	MEAN	1.0470	MEAN	1.7998
				VARIANCE	0.0283	VARIANCE	0.0562	VARIANCE	0.0284
7013	HLE1NG	HLE1N G	072987	160000	5.2041	50000	4.6990	1600	3.2041
7016	HLE2MG	HLE2M G	072987	5000000	6.6990	5000000	6.6990	1650	3.2175
7039	HLE2NG	HLE2N G	073087	44000000	7.6435	39000000	7.5911	140	2.1461
7044	HLE3MG	HLE3M G	073087	92000000	7.9638	91000000	7.9590	23000	4.3617
7067	HLE3NG	HLE3N G	073187	16000000	7.2041	8000000	6.9031	-100	2.0000

7073	HUE4MG	HUE4M G	073187	21000000	7.3227	20000000	7.3010	1220	3.0864
7091	HUE4NG	HUE4N G	080187	47000000	7.6721	45000000	7.6532	4000	3.6021
7094	HUE5MG	HUE5M G	080187	29000000	7.4624	26000000	7.4150	150	2.1761
7068	HUE3NGOC	HUE3N GOC	073187	12000000	7.0792	10000000	7.0000	100	2.0000
7045	HUE4MGOC	HUE4M GOC	073087	1599999	6.2041	1599999	6.2041	1000	3.0000
7069	HUE3NGS	HUE3N GS	073187	2400000	6.3802	2000000	6.3010	340	2.5315
7074	HUE4MGS	HUE4M GS	073187	28000000	7.4472	26000000	7.4150	660	2.8195
				MEAN	7.1464	MEAN	7.0275	MEAN	2.9742
				VARIANCE	0.6623	VARIANCE	0.9184	VARIANCE	0.5875
7751	HRU1MG	HRU1M G	081087	200000000	8.3010	150000000	8.1761	3700000	6.5682
7748	HRU1NG	HRU1N G	081087	1130000000	9.0531	140000000	8.1461	7900000	6.8976
7755	HRU2MG	HRU2M G	081187	550000000	8.7404	300000000	8.4771	9500	3.9777
7758	HRU2NG	HRU2N G	081187	110000000	8.0414	35000000	7.5441	210000	5.3222
7824	HRU3MG	HRU3M G	081287	690000000	8.8388	340000000	8.5315	31000	4.4914
7821	HRU3NG	HRU3N G	081287	1600000000	9.2041	560000000	8.7482	7000	3.8451
7844	HRU4MG	HRU4M G	081387	1500000000	9.1761	570000000	8.7559	1000	3.0000
7847	HRU4NG	HRU4N G	081387	1490000000	9.1732	720000000	8.8573	-100	2.0000
7850	HRU5NG	HRU5N G	081387	650000000	8.8129	410000000	8.6128	100	2.0000
7818	HRU3MGOC	HRU3M GOC	081287	1480000000	9.1703	660000000	8.8195	4000	3.6021
7817	HRU3MGOC	HRU3M GOC	081287	1290000000	9.1106	340000000	8.5315	2100	3.3222
7752	HRU1MGR	HRU1M GR	081087	250000000	8.3979	170000000	8.2304	7500000	6.8751
7851	HRU5NGR	HRU5N GR	081387	660000000	8.8195	340000000	8.5315	100	2.0000
				MEAN	8.8157	MEAN	8.4277	MEAN	4.2336
				VARIANCE	0.1484	VARIANCE	0.1518	VARIANCE	2.8350
7428	HBY1NG	HBY1N G	080587	95000000	7.9777	12000000	7.0792	-1000	3.0000
7462	HBY2MG	HBY2M G	080787	790000000	8.8976	360000000	8.5563	-10000	4.0000
7430	HBY2NG	HBY2N G	080587	890000000	8.9494	290000000	8.4624	100000	5.0000
7432	HBY3MG	HBY3M G	080587	22000000	7.3424	6000000	6.7782	-10000	4.0000
7474	HBY3NG	HBY3N G	080787	137000000	8.1367	137000000	8.1367	-10000	4.0000
7476	HBY4MG	HBY4M G	080787	107000000	8.0294	107000000	8.0294	-10000	4.0000
7479	HBY4NG	HBY4N G	080787	480000000	8.6812	30000000	7.4771	-10000	4.0000
7470	HBY3MGOC	HBY3M GOC	080787	104000000	8.0170	104000000	8.0170	-10000	4.0000
7471	HBY3MGOC	HBY3M GOC	080787	131000000	8.1173	131000000	8.1173	-10000	4.0000
7463	HBY2MGS	HBY2M GS	080787	4700000	6.6721	4700000	6.6721	-10000	4.0000
7464	HBY2NGS	HBY2N GS	080787	650000000	8.8129	60000000	7.7782	-10000	4.0000
				MEAN	8.2878	MEAN	7.7885	MEAN	4.0000
				VARIANCE	0.2920	VARIANCE	0.4063	VARIANCE	0.2857
7014	HUE1NH	HUE1N H	072987	10000	4.0000	10000	4.0000	1400	3.1461
7017	HUE2MH	HUE2M H	072987	12000000	7.0792	6000000	6.7782	10	1.0000
7038	HUE2NH	HUE2N H	073087	26000	4.4150	23000	4.3617	410	2.6128
7042	HUE3MH	HUE3M H	073087	36000000	7.5563	16000000	7.2041	2000	3.3010

7066	HUE3NH	HUE3N H	073187	49000000	6.6902	3900000	6.5911	3000	3.4771
7071	HUE4MH	HUE4M H	073187	18000000	7.2553	15000000	7.1761	1500	3.1761
7090	HUE4NH	HUE4N H	080187	25000000	7.3979	21000000	7.3222	2100	3.3010
7093	HUE5MH	HUE5M H	080187	26000000	7.4150	23000000	7.3617	19000	4.2788
7043	HUE4MHOC	HUE4M HOC	073087	7500000	6.8751	7300000	6.8633	1400	3.1461
7072	HUE3NHOC	HUE3N HOC	073187	39000000	7.5911	30000000	7.4771	3600	3.5563
				MEAN	6.4761	MEAN	6.3494	MEAN	3.0322
				VARIANCE	1.7868	VARIANCE	1.6372	VARIANCE	0.7775
7750	HRU1MH	HRU1M H	081087	6800000	6.8325	200000	5.3010	3000	3.4771
7747	HRU1NH	HRU1N H	081087	8100000	6.9085	600000	5.7782	5000	3.6990
7754	HRU2MH	HRU2M H	081187	12000000	7.0792	5000000	6.6990	47000	4.6721
7757	HRU2NH	HRU2N H	081187	6200000	6.7924	3300000	6.5185	5100	3.7076
7823	HRU3MH	HRU3M H	081287	40000000	7.6021	11000000	7.0414	31000	4.4914
7820	HRU3NH	HRU3N H	081287	16000000	7.2041	7300000	6.8633	16000	4.2041
7825	HRU3NH	HRU3N H	081287	15200000	7.1818	2800000	6.4472	30000	4.4771
7843	HRU4MH	HRU4M H	081387	18000000	7.2553	7000000	6.8451	11000	4.0414
7846	HRU4NH	HRU4N H	081387	14700000	7.1673	4800000	6.6812	17000	4.2304
7849	HRU5NH	HRU5N H	081387	18000000	7.2553	8000000	6.9031	36000	4.5563
7816	HRU3MHOC	HRU3M HOC	081287	10600000	7.0253	7200000	6.8573	25000	4.3979
7815	HRU3MHOC	HRU3M HOC	081287	13600000	7.1335	2700000	6.4314	31000	4.4914
				MEAN	7.1278	MEAN	6.5078	MEAN	4.1557
				VARIANCE	0.0518	VARIANCE	0.2740	VARIANCE	0.1534
7427	HBY1NH	HBY1N H	080587	8000000	6.9031	4000000	6.6021	3000	3.4771
7461	HBY2MH	HBY2M H	080787	6100000	6.7853	2700000	6.4314	60000	4.7782
7429	HBY2NH	HBY2N H	080587	10300000	7.0128	600000	5.7782	40000	4.6021
7431	HBY3MH	HBY3M H	080587	13000000	7.1139	3700000	6.5682	80000	4.9031
7473	HBY3NH	HBY3N H	080787	23000000	7.3617	500000	5.6990	30000	4.4771
7475	HBY4MH	HBY4M H	080787	17000000	7.2304	17000000	7.2304	60000	4.7782
7478	HBY4NH	HBY4N H	080787	3600000	6.5563	3600000	6.5563	25000	4.3979
7469	HBY3MHOC	HBY3M HOC	080787	12300000	7.0899	3700000	6.5682	20000	4.3010
7468	HBY3MHOC	HBY3M HOC	080787	29000000	7.4624	6000000	6.7782	29000	4.4624
				MEAN	6.9948	MEAN	6.4094	MEAN	4.4877
				VARIANCE	0.0642	VARIANCE	0.2374	VARIANCE	0.1977
7015	HUE1NS	HUE1N S	072987	27000000	7.4314	22000000	7.3424	840	2.9243
7018	HUE2MS	HUE2M S	072987	110000	5.0414	20000	4.3010	1460	3.1644
7037	HUE2NS	HUE2N S	073087	3100000	6.4914	1500000	6.1761	830	2.9191
7040	HUE3MS	HUE3M S	073087	30000000	7.4771	8000000	6.9031	140	2.1461
7065	HUE3NS	HUE3N S	073187	130000	5.1139	30000	4.4771	-10	1.0000
7070	HUE4MS	HUE4M S	073187	13000	4.1139	8000	3.9031	-100	2.0000
7089	HUE4NS	HUE4N S	080187	4200000	6.6232	700000	5.8451	-100	2.0000
7092	HUE5MS	HUE5M S	080187	2600000	6.4150	2100000	6.3222	-100	2.0000

7041	HUE3MSOC	HUE3M SOC	073087	30000000	7.4771	13000000	7.1139	120	2.0792
				MEAN VARIANCE	6.0004 1.2789	MEAN VARIANCE	5.6500 1.4310	MEAN VARIANCE	2.2692 0.4370
7749	HRW1MS	HRW1M S	081087	2500000	6.3979	1000000	6.0000	-100	2.0000
7746	HRW1NS	HRW1N S	081087	6500000	6.8129	800000	5.9031	100	2.0000
7753	HRW2MS	HRW2M S	081187	6100000	6.7853	3500000	6.5441	28000	4.4472
7756	HRW2NS	HRW2N S	081187	5000000	6.6990	5000000	6.6990	10400	4.0170
7822	HRW3MS	HRW3M S	081287	55000000	7.7404	20000000	7.3010	23000	4.3617
7819	HRW3NS	HRW3N S	081287	14400000	7.1584	4600000	6.6628	24000	4.3802
7842	HRW4MS	HRW4M S	081387	119000000	8.0755	76000000	7.8808	2000	3.3010
7845	HRW4NS	HRW4N S	081387	41000000	7.6128	38000000	7.5798	7000	3.8451
7848	HRW5NS	HRW5N S	081387	19000000	7.2788	1000000	6.0000	39000	4.5911
7814	HRW3MSOC	HRW3M SOC	081287	42000000	7.6232	6000000	6.7782	220000	5.3424
7813	HRW3MSOC	HRW3M SOC	081287	27000000	7.4314	1000000	6.0000	80000	4.9031
				MEAN VARIANCE	7.1734 0.2719	MEAN VARIANCE	6.7301 0.4625	MEAN VARIANCE	3.6604 0.9222
7426	HBY1NS	HBY1N S	080587	440000	5.6435	410000	5.6128	1300	3.1139
7467	HBY3MS	HBY3M S	080787	500000	5.6990	500000	5.6990	690000	5.8388
7466	HBY3MSOC	HBY3M SOC	080787	520000	5.7160	240000	5.3802	90000	4.9542
7465	HBY3MSOC	HBY3M SOC	080787	580000	5.7634	220000	5.3424	60000	4.7782
				MEAN VARIANCE	5.6712 0.0008	MEAN VARIANCE	5.6559 0.0019	MEAN VARIANCE	4.4764 1.8563
7399	POB1NG	POB1N G	080487	1000000	6.0000	-1000000	6.0000	10000	4.0000
7402	POB2MG	POB2M G	080487	92000000	7.9638	74000000	7.8692	3000000	6.4771
7404	POB2NGS	POB2N GS	080487	250000000	8.3979	6000000	6.7782	2500000	6.3979
7425	POB3MG	POB3M G	080587	18000000	7.2553	18000000	7.2553	22000000	7.3424
7442	POB3NG	POB3N G	080687	93000000	7.9685	93000000	7.9685	3100000	6.4914
7445	POB4MG	POB4M G	080687	195000000	8.2900	150000000	8.1761	8000000	6.9031
7531	POB4NG	POB4N G	080887	124000000	8.0934	124000000	8.0934	-10000	4.0000
7835	POB5MG	POB5M G	081387	940000000	8.9731	510000000	8.7076	4000	3.6021
7423	POB3MGOC	POB3M GOC	080587	3000000	6.4771	2000000	6.3010	23000000	7.3617
7424	POB3MGOC	POB3M GOC	080587	280000000	8.4472	220000000	8.3424	28000000	7.4472
7532	POB4NGR	POB4N GR	080887	270000000	8.4314	230000000	8.3617	-10000	4.0000
7403	POB2MGS	POB2M GS	080487	65000000	7.8129	60000000	7.7782	3400000	6.5315
				MEAN VARIANCE	7.7920 0.7563	MEAN VARIANCE	7.7243 0.6544	MEAN VARIANCE	5.5452 2.1984
7007	PCG1NG	PCG1N G	072987	18000000	7.2553	18000000	7.2553	15999	4.2041

7010	PCG2MG	PCG2M G	072987	6000000	6.7782	5000000	6.6990	15999	4.2041
7027	PCG2NG	PCG2N G	073087	15000000	7.1761	11000000	7.0414	1599	3.2038
7036	PCG3MG	PCG3M G	073087	1599999	6.2041	1599999	6.2041	1599	3.2038
7059	PCG3NG	PCG3N G	073187	28000000	7.4472	26000000	7.4150	6500000	6.8129
7063	PCG4MG	PCG4M G	073187	24000000	7.3802	23000000	7.3617	8400000	6.9243
7263	PCG4NG	PCG4N G	080287	5200000	6.7160	4100000	6.6128	12000000	7.0792
7266	PCG5MG	PCG5M G	080287	36000000	7.5563	15000000	7.1761	13000000	7.1139
7060	PCG3NGS	PCG3N GS	073187	56000000	7.7482	40000000	7.6021	1000000	6.0000
7064	PCG4NGS	PCG4N GS	073187	11000000	7.0414	5000000	6.6990	570000	5.7559
7035	PCG2MGOC	PCG2M GOC	073087	1599999	6.2041	1599999	6.2041	1599	3.2038
7034	PCG2MGOC	PCG2M GOC	073087	1599999	6.2041	1599999	6.2041	1599	3.2038
				MEAN	7.0642	MEAN	6.9707	MEAN	5.3433
				VARIANCE	0.1851	VARIANCE	0.1585	VARIANCE	2.8197
7745	PMH1MG	PMH1M G	081087	96000000	7.9823	54000000	7.7324	910000	5.9590
7742	PNH1NG	PNH1N G	081087	150000000	8.1761	140000000	8.1461	21000000	7.3222
7761	PMH2MG	PMH2M G	081187	40000000	7.6021	40000000	7.6021	1500000	6.1761
7765	PMH2NG	PMH2N G	081187	21000	4.3222	20000	4.3010	78000	4.8921
7812	PMH3MG	PMH3M G	081287	54000000	7.7324	45000000	7.6532	10700000	7.0294
7803	PMH3NG	PMH3N G	081287	84000000	7.9243	51000000	7.7076	2300000	6.3617
7829	PMH4MG	PMH4M G	081387	190000000	8.2788	170000000	8.2304	14600000	7.1644
7832	PMH4NG	PMH4N G	081387	260000000	8.4150	190000000	8.2788	3700000	6.5682
7763	PMH2NG	PMH2N G	081187	144000000	8.1584	72000000	7.8573	1000000	6.0000
7764	PMH2NG	PMH2N G	081187	17000	4.2304	17000	4.2304	61000	4.7853
7810	PMH3MGOC	PMH3M GOC	081287	35000000	7.5441	19000000	7.2788	6400000	6.8062
7811	PMH3MGOC	PMH3M GOC	081287	68000000	7.8325	39000000	7.5911	8500000	6.9294
7838	PMH4MGOC	PMH4M GOC	081387	115000000	8.0607	97000000	7.9868	17200000	7.2355
7839	PMH4MGOC	PMH4M GOC	081387	280000000	8.4472	250000000	8.3979	18000000	7.2553
				MEAN	7.2822	MEAN	7.1739	MEAN	6.2258
				VARIANCE	2.3125	VARIANCE	2.1676	VARIANCE	0.6843
7398	PDB1NH	PDB1N H	080487	400000	5.6021	400000	5.6021	101000	5.0043
7401	PDB2MH	PDB2M H	080487	500000	5.6990	500000	5.6990	42000	4.6232
7416	PDB2NH	PDB2N H	080587	1620000	6.2095	1600000	6.2041	87000	4.9395
7422	PDB3MH	PDB3M H	080587	2600000	6.4150	330000	5.5185	2000	3.3010
7441	PDB3NH	PDB3N H	080687	200000	5.3010	200000	5.3010	15000	4.1761
7444	PDB4MH	PDB4M H	080687	13000	4.1139	13000	4.1139	8000	3.9031
7530	PDB4NH	PDB4N H	080887	1500000	6.1761	1500000	6.1761	490000	5.6902
7833	PDB5MH	PDB5M H	081387	1000000	6.0000	1000000	6.0000	300000	5.4771
7421	PDB3MHOC	PDB3M HOC	080587	2100000	6.3222	230000	5.3617	2000	3.3010
7420	PDB3MHOC	PDB3M HOC	080587	1390000	6.1430	560000	5.7482	1000	3.0000
				MEAN	5.6896	MEAN	5.5768	MEAN	4.6393
				VARIANCE	0.4714	VARIANCE	0.3958	VARIANCE	0.5722

7008	PCG1NH	PCG1N H	072987	2000000	6.3010	1800000	6.2553	920	2.9638
7011	PCG2MH	PCG2M H	072987	300000	5.5770	180000	5.2553	700	2.8451
7025	PCG2NH	PCG2N H	073087	11000	4.0414	4000	3.6021	15000	4.1761
7033	PCG3MH	PCG3M H	073087	52000	4.7160	44000	4.6435	58000	4.7634
7058	PCG3NH	PCG3N H	073187	123000	5.0077	114000	5.0569	53000	4.7243
7062	PCG4MH	PCG4M H	073187	1200000	6.0772	1150000	6.0607	51000	4.7076
7262	PCG4NH	PCG4N H	080287	710000	5.8513	650000	5.8129	130000	5.1377
7265	PCG5MH	PCG5M H	080287	4300000	6.6335	2400000	6.3002	6000	3.7782
7032	PCG2MHOC	PCG2M HOC	073087	800000	5.9031	130000	5.1139	44000	4.6435
				MEAN	5.5365	MEAN	5.3833	MEAN	4.1373
				VARIANCE	0.6614	VARIANCE	0.7801	VARIANCE	0.6555
7744	PNH1MH	PNH1M H	081087	-10000	4.0000	-10000	4.0000	15000	4.1761
7741	PNH1NH	PNH1N H	081087	100000	5.0000	90000	4.9542	4000	3.6021
7760	PMH2MH	PMH2M H	081187	13000	4.1139	11000	4.0414	7900000	6.8976
7809	PMH3MH	PMH3M H	081287	4700000	6.6721	4300000	6.6335	440000	5.6435
7802	PMH3NH	PMH3N H	081287	160000	5.2041	150000	5.1761	20000	4.3010
7828	PMH4MH	PMH4M H	081387	600000	5.7782	600000	5.7782	200000	5.3010
7831	PMH4NH	PMH4N H	081387	120000	5.0792	120000	5.0792	40000	4.6021
7807	PMH3MHOC	PMH3M HOC	081287	5800000	6.7634	5600000	6.7482	210000	5.3222
7808	PMH3MHOC	PMH3M HOC	081287	5500000	6.7404	5100000	6.7076	60000	4.7782
7840	PMH4MHOC	PMH4M HOC	081387	1400000	6.1461	1000000	6.0000	141000	5.1492
7841	PMH4MHOC	PMH4M HOC	081387	1600000	6.2041	1300000	6.1139	110000	5.0414
				MEAN	5.1211	MEAN	5.0946	MEAN	4.9319
				VARIANCE	0.7331	VARIANCE	0.7385	VARIANCE	1.0505
7397	PDB1NS	PDB1N S	080487	4200000	6.6232	4200000	6.6232	131000	5.1173
7400	PDB2MS	PDB2M S	080487	7400000	6.8692	5100000	6.7076	5200000	6.7160
7415	PDB2NS	PDB2N S	080587	1100000	6.0414	1100000	6.0414	4300000	6.6335
7419	PDB3MS	PDB3M S	080587	320000	5.5051	320000	5.5051	4200000	6.6232
7440	PDB3NS	PDB3N S	080687	2100000	6.3222	2100000	6.3222	4100000	6.6128
7443	PDB4MS	PDB4M S	080687	700000	5.8451	700000	5.8451	1600000	6.2041
7529	PDB4NS	PDB4N S	080887	800000	5.9031	800000	5.9031	940000	5.9731
7834	PDB5MS	PDB5M S	081387	110000000	8.0414	50000000	7.6990	15900000	7.2014
7417	PDB3MSOC	PDB3M SOC	080587	220000	5.3424	220000	5.3424	3100000	6.4914
7418	PDB3MSOC	PDB3M SOC	080587	330000	5.5185	220000	5.3424	4900000	6.6902
				MEAN	6.3739	MEAN	6.3308	MEAN	6.3852
				VARIANCE	0.5568	VARIANCE	0.4105	VARIANCE	0.3445
7009	PCG1NS	PCG1N S	072987	48000000	7.6812	48000000	7.6812	740	2.8692
7012	PCG2MS	PCG2M S	072987	2200000	6.3424	2000000	6.3010	230000	5.3617
7025	PCG2NS	PCG2N S	073087	1420000	6.1523	1380000	6.1399	62000	4.7924
7031	PCG3MS	PCG3M S	073087	4800000	6.6812	4800000	6.6812	59000	4.7709
7057	PCG3NS	PCG3N S	073187	2250000	6.3522	2150000	6.3324	154000	5.1931

7061	PCG4MS	PCG4M S	073107	650000	5.0127	650000	5.0127	430000	5.6335
7261	PCG4NS	PCG4N S	080287	60000	4.7782	60000	4.7782	32000	4.5051
7264	PCG5MS	PCG5M S	080287	1050000	6.0712	940000	5.9731	126000	5.1004
7030	PCG2MSOC	PCG2M SOC	073087	1030000	6.0128	810000	5.9085	36000	4.5563
7028	PCG2MSOC	PCG2M SOC	073087	6000000	6.7782	5900000	6.7709	57000	4.7559
7029	PCG2MSOC	PCG2M SOC	073087	2000000	6.3010	2000000	6.3010	49000	4.6902
				MEAN	6.2277	MEAN	6.2125	MEAN	4.7783
				VARIANCE	0.5836	VARIANCE	0.5848	VARIANCE	0.6334
7743	PNH1MS	PNH1M S	081087	480000	5.6812	480000	5.6812	1300000	6.1139
7740	PNH1NS	PNH1N S	081087	-10000	4.0000	-10000	4.0000	126	2.1004
7759	PMH2MS	PMH2M S	081187	550000	5.7404	540000	5.7324	500000	5.6990
7762	PMH2NS	PMH2N S	081187	11000000	7.0414	11000000	7.0414	2700000	6.4314
7806	PMH3MS	PMH3M S	081287	6200000	6.7924	6200000	6.7924	9300000	6.9685
7801	PMH3NS	PMH3N S	081287	20000000	7.3010	8800000	6.9445	4200000	6.6232
7827	PMH4MS	PMH4M S	081387	1100000	6.0414	800000	5.9031	2400000	6.3802
7830	PMH4NS	PMH4N S	081387	43000000	7.6335	42000000	7.6232	1900000	6.2788
7804	PMH3MSOC	PMH3M SOC	081287	9800000	6.9912	9800000	6.9912	10100000	7.0043
7805	PMH3MSOC	PMH3M SOC	081287	7200000	6.8573	7200000	6.8573	8900000	6.9494
7836	PMH4MSOC	PMH4M SOC	081387	630000	5.7993	530000	5.7243	1400000	6.1461
7837	PMH4MSOC	PMH4M SOC	081387	530000	5.7243	460000	5.6628	1500000	6.1761
7826	PMH4MWS	PMH4M WS	081387	90	1.9542	42	1.6232	1500	3.1761
				MEAN	6.2789	MEAN	6.2148	MEAN	5.8244
				VARIANCE	1.2027	VARIANCE	1.1316	VARIANCE	2.0999
7005	SGC1NG	SGC1N G	072887	-10	1.0000	-10	1.0000	1200	3.0792
7006	SGC2MG	SGC2M G	072887	-10	1.0000	-10	1.0000	500	2.6990
7022	SGC2NG	SGC2N G	072987	4000	3.6021	1100	3.0414	8500	3.9294
7019	SGC3MG	SGC3M G	072987	21000000	7.3222	14000000	7.1461	210000	5.3222
7051	SGC3NG	SGC3N G	073087	1700000	6.2304	1200000	6.0792	190000	5.2788
7054	SGC4MG	SGC4M G	073087	9600000	6.9823	8900000	6.9494	180000	5.2553
7085	SGC4NG	SGC4N G	073187	28000000	7.4472	25000000	7.3979	5000	3.6990
7080	SGC5MGS	SGC5M GS	073187	4200000	6.6232	3300000	6.5185	300	2.4771
7079	SGC2MGOC	SGC2M GOC	073187	3600000	6.5563	3200000	6.5051	-100	2.0000
7050	SGC4MGOC	SGC4M GOC	073087	1599999	6.2041	1599999	6.2041	100	2.0000
7086	SGC4NGOC	SGC4N GOC	073187	30000000	7.4771	27000000	7.4314	3000	3.4771
7056	SGC3NGR	SGC3N GR	073087	1800000	6.2553	1600000	6.2041	200000	5.3010
7088	SGC4NGR	SGC4N GR	073187	30000000	7.4771	28000000	7.4472	3000	3.4771
7087	SGC4NGR	SGC4N GR	073187	28000000	7.4472	26000000	7.4150	5000	3.6990
				MEAN	5.0259	MEAN	4.8916	MEAN	3.9675
				VARIANCE	6.6761	VARIANCE	6.6711	VARIANCE	1.2383
7097	SMGING	SMGIN G	080187	32000000	7.5051	32000000	7.5051	21000	4.3222

7254	SMG2MG	SMG2M G	080787	40000000	7.6021	25000000	7.3979	-100	2.0000
7257	SMG2NGS	SMG2N GS	080287	31000000	7.4914	22000000	7.3424	-100	2.0000
7260	SMG3MG	SMG3M G	080287	40000	4.6021	10000	4.0000	800	2.9031
7361	SMG3NG	SMG3N G	080387	19000000	7.2788	8000000	6.9031	16000	4.2041
7407	SMG4MG	SMG4M G	080487	102000000	8.0086	91000000	7.9590	3000	3.4771
7410	SMG4NG	SMG4N G	080487	80000000	7.9031	68000000	7.8325	14000	4.1461
7413	SMG5MG	SMG5M G	080487	280000000	8.4472	90000000	7.9542	4700000	6.6721
7255	SMG2MGOC	SMG2M GOC	080287	35000000	7.5441	11000000	7.0414	400	2.6021
7256	SMG2MGOC	SMG2M GOC	080287	25000000	7.3979	17000000	7.2304	1100	3.0414
				MEAN	7.3353	MEAN	7.0789	MEAN	3.9607
				VARIANCE	1.3694	VARIANCE	1.7004	VARIANCE	1.8247
7435	SJR1MG	SJR1M G	080587	16000000	7.2041	16000000	7.2041	-10000	4.0000
7438	SJR1NG	SJR1N G	080587	16000000	7.2041	16000000	7.2041	-10000	4.0000
7451	SJR2MG	SJR2M G	080687	114000000	8.0569	114000000	8.0569	8600	3.9345
7457	SJR2NG	SJR2N G	080687	143000000	8.1553	143000000	8.1553	3000	3.4771
7519	SJR3MG	SJR3M G	080887	38000000	7.5798	28000000	7.4472	-10000	4.0000
7522	SJR3NG	SJR3N G	080887	144000000	8.1584	144000000	8.1584	-10000	4.0000
7528	SJR4NG	SJR4N G	080887	100000000	8.0000	100000000	8.0000	-10000	4.0000
7525	SJR4NG	SJR4N G	080887	95000000	7.9777	95000000	7.9777	-100000	5.0000
7450	SJR2MGOC	SJR2M GOC	080687	60	1.7782	10	1.0000	142	2.1523
7456	SJR2NGOC	SJR2N GOC	080687	146000000	8.1644	118000000	8.0719	10000	4.0000
				MEAN	7.7920	MEAN	7.7755	MEAN	4.0515
				VARIANCE	0.1438	VARIANCE	0.1528	VARIANCE	0.1571
7001	SGC1NH	SGC1N H	072887	61000	4.7853	18000	4.2553	332	2.5211
7002	SGC2MH	SGC2M H	072887	18200	4.2601	2100	3.3222	70	1.8451
7023	SGC2NH	SGC2N H	072987	100000	5.0000	70000	4.8451	3700	3.5682
7020	SGC3MH	SGC3M H	072987	3800000	6.5798	3700000	6.5682	3100	3.4914
7047	SGC3NH	SGC3N H	073087	25000	4.3979	22200	4.3464	1400	3.1461
7053	SGC4MH	SGC4M H	073087	19000	4.2788	14600	4.1644	30000	4.4771
7083	SGC4NH	SGC4N H	073187	6500000	6.8129	6100000	6.7853	6600	3.8195
7078	SGC2MHOC	SGC2M HOC	073187	7000000	6.8451	1800000	6.2553	19000	4.2788
7049	SGC4MHOC	SGC4M HOC	073087	1300000	6.1139	780000	5.8921	3600	3.5563
7084	SGC4NHOC	SGC4N HOC	073187	20000000	7.3010	19000000	7.2788	6900	3.8388
7055	SGC4MHR	SGC4M HR	073087	13000	4.1139	9000	3.9542	31000	4.4914
				MEAN	5.1593	MEAN	4.8981	MEAN	3.2669
				VARIANCE	1.0116	VARIANCE	1.4419	VARIANCE	0.6434
7096	SMG1NH	SMG1N H	080187	15000000	7.1761	14000000	7.1461	34000	4.5315
7252	SMG2MH	SMG2M H	080287	3800000	6.5798	2900000	6.4624	900000	5.9542
7253	SMG2NH	SMG2N H	080287	640000	5.8062	320000	5.5051	150000	5.1761
7258	SMG3MH	SMG3M H	080287	40000	4.6021	40000	4.6021	112000	5.0492
7360	SMG3NH	SMG3N H	080387	13000000	7.1139	4000000	6.6021	2500000	6.3979

7406	SMG4MH	SMG4M H	080487	3000000	6.4771	1200000	6.0792	2250000	6.3522
7409	SMG4NH	SMG4N H	080487	6700000	6.8261	2000000	6.3010	4100000	6.6128
7412	SMG5MH	SMG5M H	080487	1000000	6.0000	800000	5.9031	142000	5.1523
7251	SMG2MHOC	SMG2M HOC	080287	13000000	7.1139	9400000	6.9731	300000	5.4771
7250	SMG2MHOC	SMG2M HOC	080287	3600000	6.5563	2600000	6.4150	700000	5.8451
7414	SMG5MHR	SMG5M HR	080487	200000	5.3010	100000	5.0000	128000	5.1072
				MEAN	6.3227	MEAN	6.0751	MEAN	5.6533
				VARIANCE	0.6286	VARIANCE	0.5188	VARIANCE	0.5195
7434	SJR1MH	SJR1M H	080587	3300000	6.5185	400000	5.6021	220000	5.3424
7437	SJR1NH	SJR1N H	080587	5500000	6.7404	310000	5.4914	2600000	6.4150
7449	SJR2MH	SJR2M H	080687	13100000	7.1173	9300000	6.9685	1300000	6.1139
7455	SJR2NH	SJR2N H	080687	6000000	6.7782	2100000	6.3222	1000000	6.0000
7518	SJR3MH	SJR3M H	080887	42000000	7.6232	29000000	7.4624	8600000	6.9345
7521	SJR3NH	SJR3N H	080887	5300000	6.7243	5300000	6.7243	16000000	7.2041
7524	SJR4MH	SJR4M H	080887	20000000	7.3010	20000000	7.3010	5600000	6.7482
7527	SJR4NH	SJR4N H	080887	2300000	6.3617	2300000	6.3617	3500000	6.5441
7448	SJR2MHOC	SJR2M HOC	080687	3100000	6.4914	2200000	6.3424	1230000	6.0899
7454	SJR2NHOC	SJR2N HOC	080687	9700000	6.9868	2400000	6.3802	1300000	6.1139
7439	SJR1NHR	SJR1N HR	080587	5200000	6.7160	320000	5.5051	2700000	6.4314
7458	SJR2NHR	SJR2N HR	080687	3000000	6.4771	3000000	6.4771	1000000	6.0000
				MEAN	6.8956	MEAN	6.5292	MEAN	6.4128
				VARIANCE	0.1547	VARIANCE	0.4631	VARIANCE	0.3042
7003	SGC1NS	SGC1N S	072887	400000	5.6021	115000	5.0607	426	2.6294
7004	SGC2MS	SGC2M S	072887	9000	3.9542	2000	3.3010	100	2.0000
7024	SGC2NS	SGC2N S	072987	157000	5.1959	35000	4.5441	6300	3.7993
7021	SGC3MS	SGC3M S	072987	340000	5.5315	200000	5.3010	240000	5.3802
7046	SGC3NS	SGC3N S	073087	2800	3.4472	2200	3.3424	13000	4.1139
7052	SGC4MS	SGC4M S	073087	200000	5.3010	195000	5.2900	7300	3.8633
7081	SGC4NS	SGC4N S	073187	770000	5.8865	590000	5.7709	56000	4.7482
7076	SGC2MSOC	SGC2M SOC	073187	10000000	7.0000	9900000	6.9956	10600	4.0253
7075	SGC2MSOC	SGC2M SOC	073187	1600000	6.2041	1100000	6.0414	17000	4.2304
7077	SGC2MSOC	SGC2M SOC	073187	650000	5.8129	640000	5.8062	6500	3.8129
7048	SGC4MSOC	SGC4M SOC	073087	30000000	7.4771	23000000	7.3617	-10	1.0000
7082	SGC4NSOC	SGC4N SOC	073187	810000	5.9085	580000	5.7634	43000	4.6335
				MEAN	4.9863	MEAN	4.6586	MEAN	3.7906
				VARIANCE	0.7234	VARIANCE	0.8284	VARIANCE	1.1583
7246	SMG2MS	SMG2M S	080287	540000	5.7324	430000	5.6335	13600	4.1335
7095	SMG1NS	SMG1N S	080187	950000	5.9777	900000	5.9542	23000	4.3617
7249	SMG2NS	SMG2N S	080287	510000	5.7076	410000	5.6128	19300	4.2856
7259	SMG3MS	SMG3M S	080287	560000	5.7482	200000	5.3010	9200	3.9638
7359	SMG3NS	SMG3N S	080387	1500000	6.1761	1100000	6.0414	14800	4.1703

7405 SMG4MS	SMG4M S	080487	5100000	6.7076	4900000	6.6902	10000	4.0000
7408 SMG4NS	SMG4N S	080487	5200000	6.7160	4300000	6.6335	7000	3.8451
7411 SMG5MS	SMG5M S	080487	7500000	6.8751	3100000	6.4914	4200000	6.6232
7247 SMG2MSOC	SMG2M SOC	080287	400000	5.6021	400000	5.6021	17000	4.2304
7248 SMG2MSOC	SMG2M SOC	080287	320000	5.5051	320000	5.5051	11100	4.0453
			MEAN	6.2051	MEAN	6.0447	MEAN	4.4229
			VARIANCE	0.2118	VARIANCE	0.2350	VARIANCE	0.7169
7433 SJR1MS	SJR1M S	080587	1400000	6.1461	1400000	6.1461	5000	3.6990
7436 SJR1NS	SJR1N S	080587	2100000	6.3222	2100000	6.3222	4000	3.6021
7447 SJR2MS	SJR2M S	080687	24000000	7.3802	24000000	7.3802	120000	5.0792
7453 SJR2NS	SJR2N S	080687	3000000	6.4771	3000000	6.4771	113000	5.0531
7517 SJR3MS	SJR3M S	080887	2700000	6.4314	2700000	6.4314	410000	5.6128
7520 SJR3NS	SJR3N S	080887	2000000	6.3010	2000000	6.3010	420000	5.6232
7523 SJR4MS	SJR4M S	080887	2000000	6.3010	1500000	6.1761	40000	4.6021
7576 SJR4NS	SJR4N S	080887	7000000	6.8451	7000000	6.8451	310000	5.4914
7446 SJR2MSOC	SJR2M SOC	080687	9000000	6.9542	1000000	6.0000	54000	4.7324
7452 SJR2NSOC	SJR2N SOC	080687	7400000	6.8692	7400000	6.8692	82000	4.9138
			MEAN	6.5255	MEAN	6.5099	MEAN	4.8453
			VARIANCE	0.1412	VARIANCE	0.1500	VARIANCE	0.5785

TAXONOMY DATA

Ryan Analytical Services
MOE - Grey Water Project 1987
Beak Consultants Ltd.
Bacterial Isolates Identification

Tube/ Plate No.	Date Isolated mmddyy	Target Organism	E-II Code /Media	Organism Identified
21	080387	+PA	00001	P cepacia
22	080387	-PA	00003	A lwoffii
23	080387	+PA	21043	C freundii
24	080387	-PA	00043	A anitratus
25	080387	+PA	00141	A anitratus
1	080487	+FC	34361	K pneunoniae
2	080487	+FC	34363	K pneumoniae
3	080487	+FC	32163	E cloacae
4	080487	+FC	34363	K pneumoniae
5	080487	+FC	24373	K pneumoniae
6	080487	+FC	32560	E coli
7	080487	+FC	34373	K pneumoniae
8	080487	-FC	00141	A anitratus
9	080487	-FC	00141	A anitratus
10	080487	-FC	00141	A anitratus
11	080487	+FC	22163	E cloacae
12	080487	-FC	00141	A anitratus
13	080487	+FC	20165	E agglomerans
14	080487	+FC	34763	K oxytoca
15	080487	+FC	32173	E cloacae
16	080487	+FC	32173	E cloacae
17	080487	+FC	34563	K oxytoca
18	080487	+FC	22163	E cloacae
19	080487	-FC	00143	A anitratus
20	080487	-FC	32063	E cloacae
32	080787	+FC	34172	K pneumoniae
33	080787	+FC	34361	K pneumoniae
34	080787	+FC	34163	K pneumoniae
35	080787	+FC	32361	E cloacae
51	080787	+FC	22161	E cloacae
36	080887	+EC	30165	E agglomerans
37	080887	+EC	32361	E cloacae
38	080887	+EC	32161	E cloacae
39	080887	+EC	32165	S liquefaciens
40	080887	+EC	32161	E cloacae
41	080987	+EC	22161	E cloacae
42	080987	+EC	20173	C freundii
43	080987	+EC	22163	E cloacae
44	080987	+EC	20163	C freundii
45	080987	+EC	22171	E cloacae
1	081087	+PA	Milk ag	P aeruginosa
2	081087	+PA	Milk ag	P aeruginosa?
3	081087	+PA	Milk ag	P aeruginosa
4	081087	+PA	Milk ag	P aeruginosa
5	081087	+PA	Milk ag	P aeruginosa

Ryan Analytical Services
MOE - Grey ~~Water~~ Project 1987
Beak Consultants Ltd.
Bacterial Isolates Identification

Tube/ Plate No.	Date Isolated mmddyy	Target Organism	E-II Code /Media	Organism Identified
6	081087	+PA	Milk ag	P aeruginosa
7	081087	+PA	Milk ag	P aeruginosa
8	081087	+PA	Milk ag	P aeruginosa
9	081087	+PA	Milk ag	P aeruginosa
10	081087	+PA	Milk ag	P aeruginosa
11	081087	+PA	Milk ag	P aeruginosa
12	081087	+PA	Milk ag	P aeruginosa
13	081087	+PA	Milk ag	P aeruginosa?
14	081087	+PA	Milk ag	P aeruginosa?
15	081087	+PA	Milk ag	P aeruginosa
16	081087	+PA	Milk ag	P aeruginosa
46	081087	+EC	30560	E coli
47	081087	+EC	36173	K pneumoniae
48	081087	+EC	22161	E cloacae
49	081087	+EC	31360	C freundii
50	081087	+EC	32171	E cloacae
17	081187	+PA	Milk ag	P aeruginosa
18	081187	+PA	Milk ag	P aeruginosa
19	081187	+PA	Milk ag	P aeruginosa
20	081187	+PA	Milk ag	P aeruginosa
21	081187	+PA	Milk ag	P aeruginosa
22	081187	+PA	Milk ag	P aeruginosa
23	081187	+PA	Milk ag	P aeruginosa
24	081187	+PA	Milk ag	P aeruginosa
25	081187	+PA	Milk ag	P aeruginosa
26	081187	+PA	Milk ag	P aeruginosa
27	081187	+PA	Milk ag	P aeruginosa
28	081187	+PA	Milk ag	P aeruginosa
29	081187	+PA	Milk ag	P aeruginosa
30	081187	+PA	Milk ag	P aeruginosa
31	081187	+PA	Milk ag	P aeruginosa
32	081187	+PA	Milk ag	P aeruginosa
51	081187	+EC	32163	E cloacae
52	081187	+EC	00041	A anitratus
53	081187	+EC	36560	E coli
54	081187	+EC	31161	C freundii
55	081187	+EC	32371	E cloacae
56	081287	+EC	200143	E agglomerans
57	081287	+EC	321633	E cloacae
58	081287	+EC	36363	K pneumoniae
59	081287	+EC	32163	E cloacae
60	081287	+EC	32541	E sakazakii
61	081287	+EC	34777	K oxytoca
62	081287	+EC	32157	E cloacae
63	081287	+EC	32177	?????

Ryan Analytical Services
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Bacterial Isolates Identification

Tube/ Plate No.	Date Isolated mmddyy	Target Organism	E-II Code /Media	Organism Identified
64	081287	+EC	30173	C freundii
65	081287	+EC	32173	C freundii
66	081287	+EC	32163	E cloacae
67	081287	+EC	32161	E cloacae
68	081287	+EC	30561	C amalonticus
69	081287	+EC	30561	C amalonticus
70	081287	+EC	32163	E cloacae
71	081287	+EC	24363	K pneumoniae
72	081287	+EC	32363	E cloacae
73	081287	+EC	32160	C freundii
74	081287	+EC	32163	E cloacae
75	081287	+EC	32163	E cloacae
76	081287	+EC	32163	E cloacae
77	081287	+EC	32143	E cloacae
78	081287	+EC	32573	C amalonticus
79	081287	+EC	32540	E coli
80	081287	+EC	32163	E cloacae
84	081287	+PA	Milk ag	P aeruginosa
85	081287	+PA	Milk ag	P aeruginosa
86	081287	+PA	Milk ag	P aeruginosa
87	081287	+PA	Milk ag	P aeruginosa
88	081287	+PA	Milk ag	P aeruginosa
89	081287	+PA	Milk ag	P aeruginosa
90	081287	+PA	Milk ag	P aeruginosa
91	081287	+PA	Milk ag	P aeruginosa
92	081287	+PA	Milk ag	P aeruginosa
93	081287	+PA	Milk ag	P aeruginosa
94	081287	+PA	Milk ag	P aeruginosa
95	081287	+PA	Milk ag	P aeruginosa
96	081287	+PA	Milk ag	P aeruginosa
97	081287	+PA	Milk ag	P aeruginosa
98	081287	+PA	Milk ag	P aeruginosa
99	081287	+PA	Milk ag	P aeruginosa
81	081387	+EC	32163	E cloacae
82	081387	+EC	31163	C freundii
83	081387	+EC	32163	E cloacae
84	081387	+EC	30560	E coli
85	081387	+EC	32163	E cloacae

APPENDIX B

PUMPOUT SURVEY RESULTS

SURVEY OF REGIONAL PUMPOUT FACILITIES

SURVEY CODE	BUSINESS NAME	BUSINESS ADDRESS	MARINA	MONTHS OPEN	DAYS OPEN (1=Yes) S M T W T F S	HOURS OPEN O	HOURS OPEN C	HOLDING TANK	SEWER	TILE BED	NO OF TANKS	TOTAL CAPACITY (L)	HAUL PER MONTH	NUMBER PUMPED PER DAY	NUMBER PUMPED PER WEEK	BOAT LENGTH	BOAT DRAFT
LKF-355	SCOTTY'S MOBILE MARINE	BOX 519 LAKEFIELD, ONTARIO	T					F	F	F							
LKF-356	KAWARTHA PARK MARINA (STONY LAKE)	R.R.4 LAKEFIELD, ONTARIO	T	5 10	1111111	800	2000	T	F	F	1	13500		2	10	13.7	3.0
LKF-357	DEER BAY MARINA (BURLEIGH FALLS)	R.R.4 LAKEFIELD, ONTARIO	T	5 10	1111111	800	2030	T	F	T	1		1	1	5	13.7	1.8
LKF-358	BLOOHORN YACHT HARBOUR	R.R.1 LAKEFIELD, ONTARIO	T	5 10	1111111	800	1800	T	F	T	1	180		1	10	18.3	2.4
LKF-359	MARANATHA MARINA AND LODGE	R.R.1 LAKEFIELD, ONTARIO	T	5 9	1111111	800	1800	T	F	F	1	8100	2	4	17	13.0	1.2
BOB-360	BIRCH POINT MARINA LTD.	R.R. 2 BOBCAYGEON, ONTARIO	T	5 10	1111111	800	2000	T	F	T	1	1125		1	5	16.2	1.8
BOB-361	CENTRE POINT LANDING AND MARINA	BOX 579 BOBCAYGEON, ONTARIO	T	5 10	1111111	700	2200	T	F	T	1	22500		6	30	18.3	2.1
BOB-362	GORDON YACHT HARBOUR	BOX 909, BOBCAYGEON, ONT.	T	5 10	1111111	830	2100	T	T	F	:	360		5	40	21.9	2.4
BOB-363	MIDWAY MARINA	BOX 640 BOBCAYGEON, ONTARIO	T	4 11	1111111	700	2030	T	F	F	1	9000	4	10	50	30.5	2.4
DUN-364	DAVE'S MARINE SALES (STURGEON LAKE)	R.R.2 KENNEDY BAY, DUNSFORD, ONT.	T	5 10	1111111	800	2100	T	F	T	1	270		5	30	16.8	1.8
DUN-365	V.E.MCLAREN MARINA (THURSTONIA PK.)	R.R.2 DUNSFORD, ONTARIO	T	5 10	1111111	800	2000	T	F	F	1	900			40		
LIN-366	SNUG HARBOUR MARINE LTD.	R.R. 6 LINDSAY, ONTARIO	T	5 10	1111111	800	2000	T	F	T	1	900		1	10	12.8	1.4
CAM-367	MAMMA LODGE (BALSAM LAKE)	R.R.1 CAMERON, ONTARIO	T	5 10	1111111	830	2000	T	F	F	1	1350	2	3	15	10.7	1.8
FNF-368	SKINNER'S MARINA (ROSEDALE)	R.R.1 FENELON FALLS, ONTARIO	T	4 11	1111111	800	2000	T	F	F	1	9000	2	5	50	21.3	1.8
FNF-369	FLEMING'S MARINA (ROSEDALE)	R.R.1 FENELON FALLS, ONTARIO	T	5 10	1111111	800	2100	T	F	F	1	9000	8	3	15	18.3	1.6
FNF-370	KING'S MARINA	BOX 98 FENELON FALLS, ONTARIO	T	5 10	1111111	800	2100	F	F	F	0						
CLW-471	BIG CHUTE MARINA	R.R.1 COLDWATER, ONTARIO	T	5 10	1111111	830	2000	T	F	F	2	5625	1	3	15	21.3	3.4
SVF-472	SEVERN COVE MARINA (SEVERN FALLS)	R.R.1 COLDWATER, ONTARIO	T					F	F	F							
PSV-473	WHITE'S FALLS MARINE/CONSTRUCTION	BOX 97 PORT SEVERN, ONTARIO	T	5 10	1111111	900	2100	T	F	T	1	900		4	20	18.3	3.0
HNH-474	ADMIRAL'S MARINA INC.	BOX 39 HONEY HARBOUR, ONTARIO	T	4 10	1111111	800	2000	T	F	F	2	2430	2	6	40	11.6	4.4
HNH-475	VILLAGE MARINA LTD.	% GEN. DELIVERY, HONEY HARBOUR, ONT	T	5 10	1111111	700	2100	T	F	F	1	4500	1	12	40	14.9	2.4
VCH-476	QUEEN'S COVE MARINA	BOX 333 VICTORIA HARBOUR, ONTARIO	T	5 10	1111111	800	1700	F	T	F				4	75	24.4	2.4
PMN-477	DUNCAN'S MARINA	BOX 81 PORT MCNICOLL, ONTARIO	T	5 10	1111111	700	1900	T	F	F	1	900		2	8	12.2	1.8
PTG-478	PENETANG. TOWN (COM. GOV.) DOCKS	DOWNTOWN PENETANGUISHENE, ONTARIO	F	5 10	1111111	600	2100	T	T	F	1	4500		2	10	18.3	9.1
PTG-479	DUTCHMAN'S COVE MARINA	BOX 1390 PENETANGUISHENE, ONT.	T	5 11	1111111	1200	2400	T	F	F	1	9000	4	15	100	26.0	2.7
PTG-480	BAY MOORINGS MARINA (BUTLER MARINE)	BOX 29 PENETANGUISHENE, ONTARIO	T	5 10	1111111	800	1800	T	F	F	1	9000	4	15	100	18.3	1.5
PTG-481	BEACON BAY MARINA	BOX 1570 PENETANGUISHENE, ONTARIO	T	5 10	1111111	800	2000	T	F	F	2	9000	4	15	100	22.9	2.4
PTG-482	HINDSON MARINE	BOX 525 PENETANGUISHENE, ONTARIO	T	5 11	1111111	800	2000	T	F	F	1	9000	2	15	200	18.3	2.1
PTG-483	BAY MARINE	BOX 959 PENETANGUESHENE, ONTARIO	F					F	F	F							
PTG-484	NORTHWEST BASIN MARINE	BOX 1094 PENETANGUESHENE, ONTARIO	F					F	F	F							
PTG-485	MATLLOUX (LUG CITY)	S.S.2 SITE 21 COMP.6, PENETANG.	F	5 10	1111111	800	2100	T	F	F	1	9000	1	2	15	15.2	1.5
BLB-486	COVE MARINA	YARDWOOD POINT, BALM BEACH, ONTARIO	F					F	F	F							
MID-487	DOWER'S YACHT HAVEN	171 KING STR., MIDLAND, ONTARIO	T	4 11	1111111	900	2100	T	F	F	:	3150	8	5	34	30.5	7.6
MID-488	MIDLAND BAY SAILING CLUB	BOX 63 MIDLAND, ONTARIO	F	5 10	1111111	1200	2400	T	F	F	:	4500	1	2	10	11.6	3.0
MID-489	SUNNYSIDE MARINA	BOX 35 MIDLAND, ONTARIO	T	5 10	1111111	900	2000	T	F	F	2	11250	1	1	5	18.3	3.7
MID-490	MIDLAND BAY MARINA	156 WILLIAM STR., MIDLAND, ONTARIO	F					F	F	F							
MID-491	WYE HERITAGE MARINA	BOX 474 MIDLAND, ONTARIO	T	5 11	1111111	800	2000	T	F	T	4	20700			800	30.5	2.7
SLE-592	BUENA VISTA RESORT	R.R. 1 SLEEMAN, ONTARIO	T	5 10	1111111	700	2200	T	F	T	1	2250		2	12	21.3	3.7
KEN-593	DOGTOOTH RESORT	BOX 437 KENORA, ONTARIO	T	5 10	1111111	800	2200	F	F	F							
HAB-594	MORSON MARINA	HANSON'S BAY, ONTARIO	T	5 10	1111111	800	1700	T	F	F	1	13500	1	3	18	27.4	1.2
SLE-595	BAYVIEW TRAILER PARK	BOX 11 SLEEMAN, ONTARIO	F	5 11	1111111	700	2200	T	F	T	1	22500		1	5	15.2	1.8
LOW-596	LAKE OF THE WOODS HOUSEBOATS	BOX 179 SIOUX NARROWS, ONTARIO	T	5 10	1111111	730	2000	:	F	F	1	2250	2	2	16	18.3	2.4
SLE-597	COLLINSON'S RESORTS LTD.	R.R. 1 SLEEMAN, ONTARIO	T	5 10	1111111	700	2300	T	F	F	1	3375				15.2	1.8
KEN-598	NORTHERN HARBOUR MARINE	BOX 2460 KENORA, ONTARIO	T	5 11	1111111	700	2130	T	F	T	1	5400		5	60	24.4	2.7

SURVEY CODE	BUSINESS NAME	BUSINESS ADDRESS	MARINA	MONTHS OPEN		DAYS OPEN (1=Yes) S M T W T F S	HOURS OPEN O	C	HOLDING TANK	SEWER	USED	NO OF TANKS	TOTAL CAPACITY (L)	AVE PER MONTH	NUMBER DAY	USED	BOAT LENGTH	DRAFT
OAK-101	OAKVILLE POWER BOAT CLUB	WATER STREET,OAKVILLE,ONTARIO	F	4	10	1 0 1 0 1 1 1	900	2000	F	T	F	0	0	0	2	10	14 0	7 1
OAK-102	OAKVILLE HARBOUR DEVELOP AUTHORY	NO. 5 WALKER STR , OAKVILLE,ONTARIO	F	6	10	0 0 0 0 1 0 1	900	1800	F	T	F	0	0	0	7	15	12 8	2 1
OAK-103	METRO MARINE LTD	2508 LAKESHORE BLVD W.,OAKVILLE	T	6	11	1 1 1 1 1 1 1	900	1700	F	T	F	0	0	0	6	30	20 4	3 0
PCT-104	PORT CREDIT HARBOUR MARINA	NO. 1 PORT STR E.,MISSISSAUGA	T	5	11	1 1 1 1 1 1 1	900	1600	F	T	F	0	0	0	0	19	19 2	8 5
PCT-105	PORT CREDIT YACHT CLUB	NO.1 STAVEBANK RD.,MISSISSAUGA	F	5	10	1 0 1 1 1 1 1	1100	1800	F	T	F	0	0	0	10	60	17 8	2 1
TOR-106	ETOBICOKE YACHT CLUB	2235 LAKESHORE BLVD.W.,TORONTO	F	4	10	1 1 1 1 1 1 1	1200	2400	F	T	F	0	0	0	1	10	15 2	3 0
TOR-107	MIMICO CRUISING CLUB	BOX 156 STA. N., TORONTO	F	5	10	1 0 0 1 1 1 1	900	2200	T	F	F	1	13600	0	4	30	16 8	3 7
TOR-108	THE BOULEVARD CLUB	1491 LAKESHORE BLVD.W.,TORONTO	F	5	10	1 1 1 1 1 1 1	1200	2400	F	T	F	0	0	0	2	10	10 7	2 1
TOR-109	ONTARIO PLACE MARINA	955 LAKESHORE BLVD.W.,TORONTO	T	5	10	1 1 1 1 1 1 1	900	1800	F	T	F	0	0	0	5	30	24 4	6 1
TOR-110	NATIONAL YACHT CLUB	10 STADIUM RD.,TORONTO	F	6	10	1 1 1 1 1 1 1	1200	2400	F	T	F	0	0	0	24	100	11 6	2 4
TOR-111	ALEXANDRIA YACHT CLUB	24 STADIUM RD.,TORONTO	F	5	10	0 1 1 1 1 1 0	800	2000	F	T	F	0	0	0	2	7	9 1	3 0
TOR-112	ASHBRIDGE'S BAY YACHT CLUB	BOX 64 STA. N,TORONTO	F	5	11	1 1 1 1 1 1 1	800	2000	F	T	F	0	0	0	3	20	13 7	1 6
SCA-113	BLUFFER'S PARK MARINA	7 BRIMLEY RD.S.,SCARBOROUGH	T	5	11	1 1 1 1 1 1 1	600	2000	T	T	F	1	2250	0	10	50	18 3	3 7
SCA-114	BLUFFER'S PARK YACHT CLUB	BOX 2066 STA. B.,SCARBOROUGH	F	4	11	1 1 1 1 1 1 1	1200	2400	T	T	F	1	0	0	5	20	11 3	3 0
SCA-115	HIGHLAND YACHT CLUB	BRIMLEY RD.,SCARBOROUGH	F	5	10	1 1 1 1 1 1 1	1200	2400	T	T	F	2	0	0	2	10	13 4	4 6
SCA-116	CATHEDRAL BLUFF YACHT CLUB	BOX 2266 STA. B.,SCARBOROUGH	F	5	9	1 1 1 1 1 1 1	800	2100	F	T	F	0	0	0	3	20	15.2	3 0
PIC-117	FRENCHMAN'S BAY YACHT CLUB	635 BREEZY DR.,PICKERING, ONTARIO	F	5	10	1 1 1 1 1 1 1	800	2400	F	T	F	0	0	0	2	6	10 7	1 8
PIC-118	MOOREHAVEN WHARF MARINA	1289 WHARF STR., PICKERING, ONTARIO	T	5	11	1 1 1 1 1 1 1	900	2100	T	T	F	1	4500	0	8	70	13 7	1 8
PIC-119	EAST SHORE MARINA	1295 WHARF STR., PICKERING,ONTARIO	T	4	11	1 1 1 1 1 1 1	1200	2400	T	T	F	1	22500	0	0	0	18 3	2 4
PIC-120	PORT PICKERING MARINA (KEENE KRAFT)	680 FRONT STR.,PICKERING, ONTARIO	T	4	11	0 1 1 1 1 1 1	1200	2400	F	T	F	0	0	0	2	20	18.3	2 4
WIT-121	PORT WHITBY MARINA	575 ROSSLAND RD. E.,WHITBY,ONTARIO	T	4	11	1 1 1 1 1 1 1	800	2000	T	T	F	1	0	0	5	30	18 3	3 0
OSH-122	PORT OSHAWA MARINA	1050 FAIRWELL AVE.,OSHAWA,ONTARIO	T	5	11	1 1 1 1 1 1 1	1200	2400	F	T	F	0	0	0	4	20	21.3	2 4
KIG-223	COLLINS BAY MARINA	1089 BATH RD.,KINGSTON, ONTARIO	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	13600	2	1	9	15 2	1 8
KIG-224	PHILLIPS MARINE	1157 BATH RD.,KINGSTON, ONTARIO	T	5	10	0 1 1 1 1 1 1	900	2000	T	T	F	1	203	0	1	5	7 6	1 2
KIG-225	WOOD'S MARINA	4000 BATH RD.,KINGSTON,ONTARIO	T	0	0	0 0 0 0 0 0 0	0	0	F	F	F	0	0	0	0	0	0 0	0 0
KIG-226	KINGSTON YACHT CLUB	13-A MAITLAND STR.,KINGSTON	F	5	10	1 1 1 1 1 1 1	800	1800	F	T	F	0	0	0	15	50	18 2	2 4
KIG-227	PORTSMOUTH OLYMPIC HARBOUR	50 YONGE STREET, KINGSTON, ONTARIO	T	5	9	1 1 1 1 1 1 1	800	2000	F	T	F	0	0	0	5	40	18 3	2 4
KIG-228	CONFEDERATION BASIN (TOWN HARBOUR)	ONTARIO STR.,DOWNTOWN KINGSTON	F	0	0	0 0 0 0 0 0 0	0	0	F	F	F	0	0	0	0	0	0.0	0 0
KIG-229	TREASURE ISLAND MARINA	BOX 237 , R.R.1 KINGSTON, ONTARIO	T	-5	10	1 1 1 1 1 1 1	800	2200	T	F	F	1	0	0	5	30	18 3	2 1
KIG-230	RIDEAU MARINA (KINGSTON) LTD.	BOX 791 KINGSTON, ONTARIO	T	4	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	9000	0	6	40	13 7	1 5
JOF-231	HOTEL KENNEY AND MARINA	X GEN. DELIVERY, JONES FALLS	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	2250	0	8	40	18 3	2.1
JOF-232	SHANGRI-LA LODGE (JONES FALLS)	R.R.3 ELGIN, ONTARIO	F	5	10	1 1 1 1 1 1 1	900	2100	F	F	F	1	13500	0	10	75	16 8	1 5
JOF-233	SAND LAKE MARINA (JONES FALLS)	R.R.3 ELGIN, ONTARIO	T	0	0	0 0 0 0 0 0 0	0	0	F	F	F	0	0	0	0	0	0 0	0 0
CHL-234	INDIAN LAKE CAMPGROUND AND MARINA	BOX 50 ELGIN,(CHAFFEY'S LOCKS),ONT.	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	2250	0	2	12	14 6	2 1
CHL-235	BROWN'S MARINA	X GEN. DELIVERY, CHAFFEY'S LOCKS	T	4	11	1 1 1 1 1 1 1	900	1800	T	F	F	1	2025	2	4	20	18 3	2 1
CHL-236	DOROTHY'S MARINA	X GEN. DELIVERY, CAFFEY'S LOCKS	T	0	0	0 0 0 0 0 0 0	0	0	F	F	F	0	0	0	0	0	0 0	0 0
WEP-237	GRAHAM'S MARINA LTD.	RIDEAU STR.,WESTPORT, ONTARIO	T	4	10	0 1 1 1 1 1 1	800	1700	F	T	F	0	0	0	5	30	16 8	1 5
PTL-238	BAYVIEW YACHT HARBOUR	BOX 158 PORTLAND, ONTARIO	T	5	10	1 1 1 1 1 1 1	800	1800	T	F	F	1	11250	2	2	7	12 2	1 8
PTL-239	WATERSIDE MARINA AND RESTURANT	PORTLAND, ONTARIO	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	2025	2	6	30	15 2	2 4
PTL-240	LEN'S COVE MARINA	BOX 220 PORTLAND, ONTARIO	T	5	10	1 1 1 1 1 1 1	900	1800	T	F	F	2	9203	4	10	25	15 2	1 5
ROF-241	SAFARI MARINA 1970 LTD.	COUTTS BAY RD.,RIDEAU FERRY,ONTARIO	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	2250	1	15	120	18 3	2 4
SMF-242	VICTORIA PARK MUNICIPAL DOCK	RIDEAU CANAL, SMITHFALLS, ONTARIO	F	5	10	1 1 1 1 1 1 1	800	2000	F	T	F	0	0	0	3	16	13 7	3 0
PET-343	TURTLE BAY MARINA	R.R.5 PETERBOROUGH, ONTARIO	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	9000	2	8	30	18 3	1 5
PET-344	WILLOW BEND MARINA	R.R.5 PETERBOROUGH, ONTARIO	T	4	10	1 1 1 1 1 1 1	900	2100	T	F	T	1	9000	0	2	15	18 3	2 1
BON-345	THE DUTCH MARINE OF CANADA LTD.	BOX 10 BRIDGENORTH, ONTARIO	T	5	10	1 1 1 1 1 1 1	800	1700	T	F	F	1	9000	0	1	7	10 9	1 8
BON-346	OLD CAUSEWAY MARINA	BOX 437 BRIDGENORTH, ONTARIO	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	13500	4	3	10	13 7	1 7
BON-347	HOLIDAY SPORTS MARINE	BOX 299 BRIDGENORTH, ONTARIO	T	4	10	0 1 1 1 1 1 0	800	1700	T	F	F	1	900	3	0	0	12 2	1 5
PET-348	PETERBOROUGH MUNICIPAL MARINA	X 500 GEORGE STR. N.,PETERBOROUGH	T	5	10	1 1 1 1 1 1 1	800	2000	T	T	F	2	0	0	5	40	24 0	1 8
BON-349	THREE BUOYS MARINA AND RESORT	BOX 450 BRIDGENORTH, ONTARIO	T	5	10	1 1 1 1 1 1 1	700	2130	T	F	F	6	54000	8	5	150	13 1	1 8
PET-350	FIFE'S BAY MARINA	R.R.2 PETERBOROUGH, ONTARIO	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	F	1	4500	0	1	4	12 2	1 5
PET-351	MAPS MARINA	542 GLENPATRICK DR.,PETERBOROUGH	T	5	10	1 1 1 1 1 1 1	800	1800	T	F	F	1	3375	2	3	30	12 2	1 7
ENN-352	EMERALD ISLE MARINA	R.R.1 ENNISMORE, ONTARIO	T	5	10	1 1 1 1 1 1 1	900	2100	T	F	F	1	2250	2	2	15	12 2	1 2
LKF-353	PRATT'S MARINA (SELWYN)	R.R.3 LAKEFIELD, ONTARIO	T	0	0	0 0 0 0 0 0 0	0	0	F	F	F	0	0	0	0	0	0 0	0 0
YOP-354	ISLANDVIEW MARINA AND TRAILER PARK	YOUNG'S POINT,ONTARIO	T	5	10	1 1 1 1 1 1 1	800	2000	T	F	T	1	22500	0	4	30	18 3	1 8